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ABSTRACT

The report presents findings from a 5-year investigation of teaching strategies and their effects on learning stages in severely handicapped students. Learning records of most of the students were found to resemble those of nonhandicapped learners, although some students demonstrated erratic variations in performance due to compliance problems. In the third project year decision-rules were formulated to help teachers identify problems in acquisition, fluency building and compliance from the students' performance records. Effectiveness of teachers who used the decision-rules was analyzed in terms of improvements in pupil performance and/or rate of progress. In year 4, teachers applied a revised set of decision rules based on questions concerning pupil data. Problems with noncompliance in children were noted and interventions attempted. Decision-rules were integrated with a minimum acceleration procedure in which the teacher specifies a minimum rate of change. Year 5 activities examined the learning of the decision-rules by 81 teachers in a wide variety of settings with varying amounts of training and assistance. Adoption of the rules resulted in successful decisions and reduced planning time. Cost data were also examined. Four site reports are presented in the document's conclusion. (CL)

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Field Initiated Research Study

AN INVESTIGATION OF PHASES OF LEARNING AND FACILITATING INSTRUCTIONAL EVENTS FOR THE SEVERELY/PROFOUNDLY HANDICAPPED

FINAL PROJECT REPORT

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January, 1981

EC 161830

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Part II

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Summary of the Project

"An Investigation of the Phases of Learning and Facilitating Instructional Events for the Severely/Profoundly Handicapped" was funded in 1975. The major objectives of this five year project were to:

(1) Investigate the relationship between the hypothesized stages of learning--acquisition, fluency building, maintenance, generalization and adaptation--and pupil performance in order to determine functional definitions of each stage;
(2) Determine if specific instructional strategies had a higher probability of facilitating pupil progress in certain stages of learning than in other stages; and
(3) Determine if and how information from the first two objectives could be easily and effectively used by classroom teachers to improve the education of their severely/profoundly handicapped pupils.

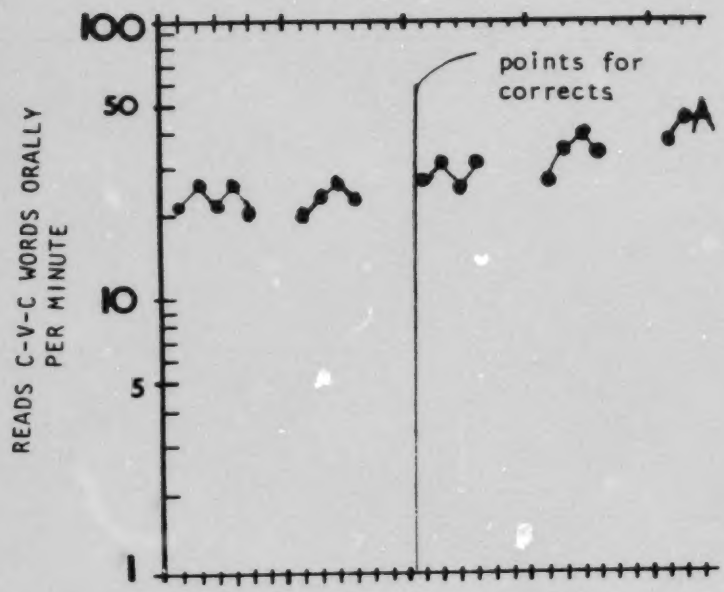
During the first two project years, the project worked with fourteen teachers, twenty pupils and a total of 40 different instructional programs. Pupils' performance was analyzed as teachers implemented a variety of instructional strategies, although no attempt was made by project staff to influence the strategies used by the teachers. Analysis of the pupils' performance data showed that the first two stages of learning could be identified, and also indicated that strategies designed to provide information on how to respond (e.g., prompting) were most effective during acquisition, while strategies designed to motivate performance (e.g., use of reinforcers) were most effective during the fluency building stage. However, it was found that teachers were far more likely to move a pupil to an easier instructional step or change the consequence for correct responses when learning failed than to change instructional strategies. During the first project year teachers selected intervention strategies that improved pupil performance 33% of the time while during the second year teachers were successful 41% of the time.

Several other discoveries were made during the first two years. It became apparent that most teachers collected data on the accuracy of performance, usually percent correct. In addition to accuracy data, project staff collected three types of time-based data to determine the temporal changes in performance. Frequency of behavior (rate per minute) data were collected on all skills at first. Later, duration data were collected on skills in which the acceleration or deceleration of duration was the primary consideration in the development of fluent performance (i.e., self-help skills such as shoe-tying are duration deceleration targets, and time on task is a duration acceleration target). Latency data were collected on skills in which the amount of time between the conclusion of the stimulus and the start of the behavior were the important measure of proficiency (i.e., answering question). We also found it necessary to modify data collection techniques for program strategies that required the presentation of antecedents or consequences for each pupil response. The "Guidelines" attached to this report include a description of data collection techniques.

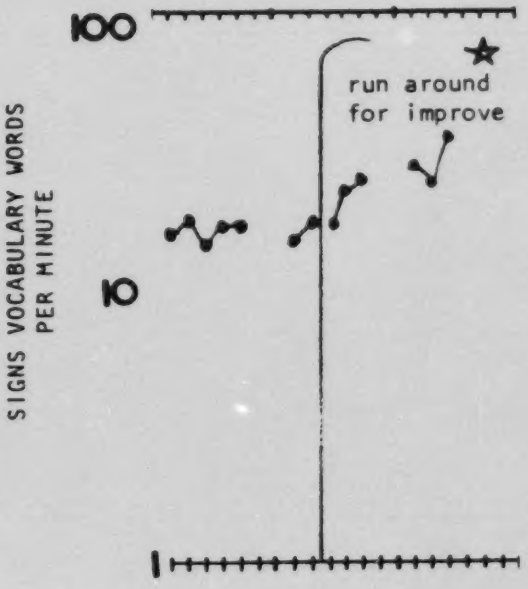
During the first two years, the project found that the learning records of most of the pupils resembled those of nonhandicapped learners (see Figure 1). Rate-of-change in performance was not noticeably different, although the target behaviors and the relative size of instructional steps were different.

Figure 1

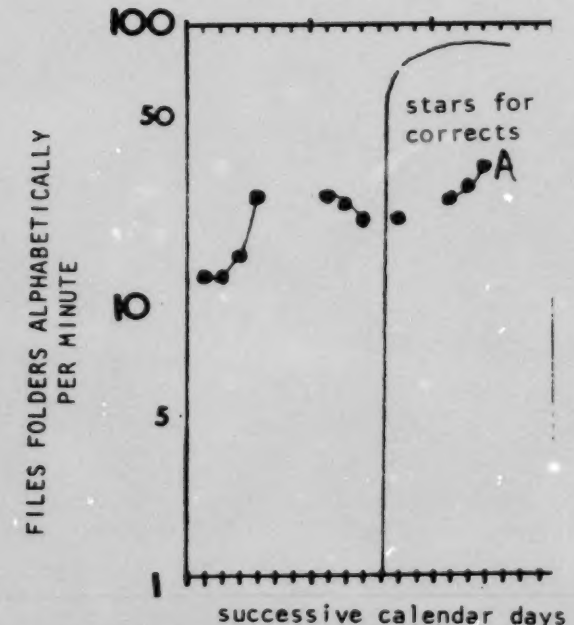
NONHANDICAPPED, HANDICAPPED, AND NON-COMPLIANT LEARNERS



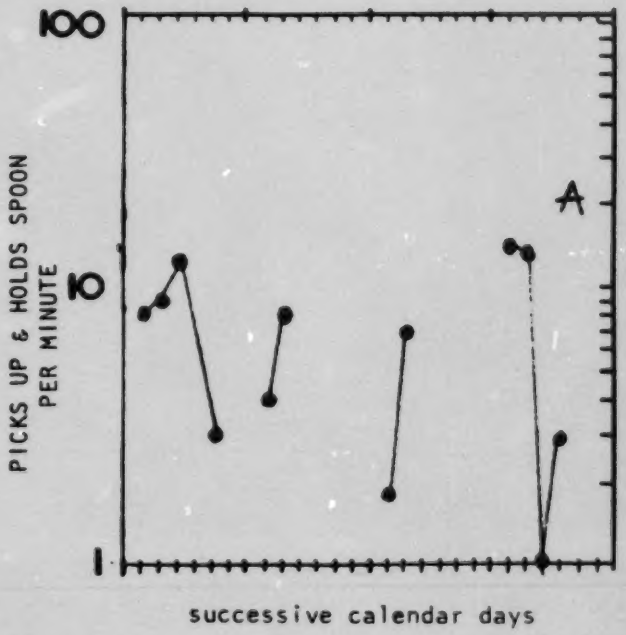
Learner: Nonhandicapped C.A. 8



Learner: Multiply Handicapped C.A.10



Learner: Severely Retarded C.A. 17



Learner: Profoundly Retarded C.A. 4

"Non-Compliant"

However, the instructional performance records of several pupils showed such erratic variations that they were impossible to classify. Performances jumped daily from 100% to 0%, from rates of 20 per minute to rates of 1 per minute (Figure 1). There was more variation, or bounce, from day-to-day than there was change over time. Extensive observation of these pupils in instructional and noninstructional situation showed a correlation between compliance to commands already in the pupils' repertoire and variability in daily instructional tasks: The less likely the pupil was to comply the more erratic instructional performance was. Such performance records were classified as "compliance problems."

During the third project year, a set of decision-rules were designed to assist teachers in the identification of problems in acquisition, fluency building and compliance from the performance records of their pupils. Those rules were implemented by six teachers and sixteen pupils at the Lake Washington Special Education Center, working closely with the research staff.

This first version of the decision-rules consisted of a series of "pictures" of pupil performance data based on both accuracy and time data. The teachers drew lines-of-progress (a.k.a. trends, slopes) on a chart of the data and then compared their "picture" with the rule pictures. Each picture was categorized as either a "problem" (e.g., acquisition, fluency-building, compliance, general) or as a successful learning pattern. Teachers could then choose from a list of suggested remedial strategies for each problem category or select an intervention of their choice. Teachers who implemented the first version of decision-rules made 65% successful decisions, i.e., decisions that improved pupil performance and/or rate of progress. Teachers were sometimes successful in selecting appropriate interventions even if they did not use one of the specifically recommended strategies. However, teachers who did use suggested strategies were generally more successful than those that used other, non-recommended strategies. One result was that teachers used a wider variety of remedial strategies than teachers in previous years. Although this may be attributed to a change in the sample of teachers under study, it may also have been due to the variety of strategies recommended by the project procedures.

During the fourth project year, four teachers from the Seattle School District applied a revised set of decision-rules in programs for 22 severely and profoundly handicapped pupils. That set of decision-rules consisted of a series of questions concerning pupil data. For example, the teacher was asked to determine if progress was accelerating or decelerating. If it was decelerating, the teacher next determined if performance was highly variable, the guidelines indicated the high probablity of a compliance problem and suggested a number of strategies for dealing with that problem. Questions were used to determine the category of pupil performance (e.g., successful learning pattern, acquistion problem, compliance problem, fluency-building problem). A revised set of recommended instructional strategies for each category was included with the decision-rules. In addition to drawing lines-of-progress, teachers were required to determine the percentage of correct responses and the degree of performance variability in order to answer the questions. Again, teachers were free to implement suggested strategies or use others of their choice. During the year, teachers used the suggested strategies 80% of the time, and 80% of their decisions resulted in improved pupil performance.

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[1] The use of general "learning pictures" of correct and error rates has been reported by O. R. Lindley (personal communication, summer, 1979).

As a result of project activities, it became even more obvious that compliance problems constituted a major challenge to classroom teachers. Not only was instructional decision-making very difficult with noncompliant students, but even correct placement within a curriculum was seriously hampered, since pupils often responded noncompliantly during initial assessments. The problems with noncompliant pupils uncovered during the first three years of the project, unanticipated by previous research, involving between 5-15% of the subjects, posed such severe problems that the project was forced to discontinue investigations into generalization and adaption, and to concentrate on identifying compliance problems in instruction and strategies that would improve compliance. We concluded that unless a pupil were compliant, any type of instruction would probably be ineffective, and that, therefore, compliance was probably a prerequisite to instruction.

During the second, third and fourth project years separate investigations into strategies for remediating compliance problems in instructional and non-instructional settings were conducted. Non-instructional settings constituted those periods when the teacher and pupil were not engaged in a pre-planned systematic instructional activity. Strategies that were successful in non-instructional settings included manipulation of contingencies for compliant and for noncompliant responses: food plus praise for compliance, and a physical mandate (a "putting through" procedure) for noncompliance or if the pupil failed to respond within five seconds. It was also found that aplying those contingencies throughout the day, whenever a compliance command was given, was more successful in improving levels and stability of compliance than applying them in a short, specially designed, compliance session. Some pupils who became more compliant during non-instructional situations also showed a reduction in variability in instructional responding -- improving the success of instructional decisions. Not all pupils improved, however.

Strategies that improved compliance in instructional programs were less successful, since it was often difficult to distinguish noncompliance from response deficits. Strategies that were successful included changing consequences for correct (compliant) responses, providing a variety of consequences for correct behavior, and reducing reinforcement to variable ratio schedules. Surprisingly, however, the most successful strategy for improving compliance in instructional programs was moving the pupil to more difficult material or higher skill levels. Some teachers eventually moved the pupil through six curricular steps before finding the appropriate instructional level. It was hypothesized that instruction at a relatively easy skill level might either be the result of noncompliance during initial assessment or the result of the loss of interest by the pupil. Pupils who were required to perform easy tasks repeatedly might become bored and thus fail to "comply" regardless of the promised consequence for correct responding. Satiation in combination with boredom may also produce noncompliance, or, manipulation of teacher behavior may serve to reinforce the pupil for noncompliant responding. A grant designed to futher investigate methods of identifying and remediating compliance problems has now been funded and should provide some information on those questions.

Despite the success of the decision-rules, by the end of the fourth project year, it was clear that there was a major problem in their application. The rules suggested that, if the trend for the pupil's correct performance for the five or seven day "decision period" were accelerating, then no change be made in the instructional strategies. New lines-of-progress were drawn every five to seven data days. According to this method, however, a pupil could show accelerating trends over several five day periods, but his ending performance at the concluding period could be lower than his ending performance over the first period-- (i.e., trends would appear as

). In addition, this method required the teacher to make a decision every five to seven days, following all of the rule-procedures--a time-consuming method if no change were required after all.

In order to remedy that situation, the decision-rules were integrated with the minimum 'celeration procedure (Liberty, 1972; White & Haring, 1976). This procedure allows the teacher to specify the minimum rate of change required to insure that the pupil's current level of performance improves to criterion levels. A line is drawn on the chart of instructional performance to indicate the desired rate of change. Guidelines for the application of these rules for rate, duration, and latency data are attached to this report. In brief, the procedures for application of the revised rules are:

1. Apply minimum 'celeration procedure
   a. Collect and chart three days of data.
   b. Draw a minimum 'celeration line from midpoint of the three days to the intersection of the performance aim and aim date.
   c. Continue collection of data.
2. Determine if change is needed
   a. If pupil meeting minimum 'celeration, no change is needed (in most cases).
   b. If pupil fails to meet minimum 'celeration for three consecutive data days, change is required.
3. Determine type of performance problem
   a. Draw line-of-progress for the five to seven most recent data days.
   b. Check performance data via flow-chart questions (Figures 2, 3, & 4).
   c. Select remediation strategy (Table 1).

Activities of the fifth project year were designed to determine if teachers in a wide variety of settings, with varying amounts of training and assistance could implement decision-rules effectively. Eighty-one teachers and therapists from around the country were trained via one of four typical training models--textbook only, large group, small group and individualized instruction. Following training, the subjects were asked to adopt the decision-rules for use with their pupils. The teachers who did adopt the rules, and who provided us with pupil performance data were 68% successful in their decisions and also reduced the time they spent planning each week. The data also indicate that teachers who followed the suggested strategies were more successful than those who did not. The cost of implementing decision-rules were as little as 7¢ per program per week.

The following report describes the subjects involved in the replication studies, the training models used, the effectiveness of the training and the impact of rules usage on pupil performance. Detailed descriptions of each training site follow the main report.

The project was able to successfully meet all major objectives, except for the investigations of generalization and adaptation. However, the importance of the identification of compliance as a problem affecting perhaps 30% of the population of the severely handicapped and seriously hampering educational progress cannot be underestimated, and the data from the final three years of the project clearly show that public school teachers of the severely handicapped can improve their instructional decision-making by applying specific, low-cost decision-rules to the data they collect on the progress of their pupils in instructional programs

Table 1

DESIGNING AND CHANGING INSTRUCTIONAL FORMATS

General Considerations

1. Are you providing the opportunity for independent responding? Have you established an allowable latency period?
2. Do you have appropriate consequences? Do you have different consequences for correct and incorrect responses?
3. Are you using appropriate signals to get the behavior started?
4. Are your materials natural and age-appropriate?
5. Is the setting for instruction appropriate?

Format Considerations for Acquisition

1. Reinforce accurate performance.
2. Provide sufficient response opportunities.
3. Provide as little assistance as possible.
4. Provide as little extra information as required.
5. Consider the entire behavior.
6. Consider generalization when you choose constant or varied stimulus events.

Strategies for Acqusition Problems

Provide additional information as a
consequence for error responses
antecedent to the opportunity to respond
or conjugate with responding

1. Change verbal/signed/gestural direction or signal.
2. Add gestural cues.
3. Add verbal cues/stress key words.
4. Add a permanent model.
5. Add a manager demonstration.
6. Add physical prompts.
7. Add an assisted demonstration.
8. Add position/color/emphasis cues to instructional materials.

Format Considerations for Fluency-Building

1. Reinforce fluent performance.
2. Increase opportunities to perform the behavior (drill & practice).
3. Increase the freedom to perform the behavior.
4. Increase the rate of teacher-presentation.
5. Consider generalization.

Strategies for Fluency-Building Problems

1. Provide directions for fluency before/during performance.
2. Add/change consequences to motivate correct/fluent responses. Use a "reinforcer survey" to identify possible consequences; provide "variable" consequences, a different type each time; hide the prize until it is earned; use conjugate consequation.
3. Change the schedule for consequation of correct/fluent responses. Increase the ratio or interval of the schedule; use a variable schedule; delay conjugate consequation.
4. Implement a changing aim strategy, increasing the amount of behavior required to receive consequation daily; tell or show the student how much "work" she/he must finish.
5. Increase the number of response opportunities.
6. Increase practice/drill.
7. Work with a more competent peer.
8. Add/change consequences for disfluent/incorrect responses.

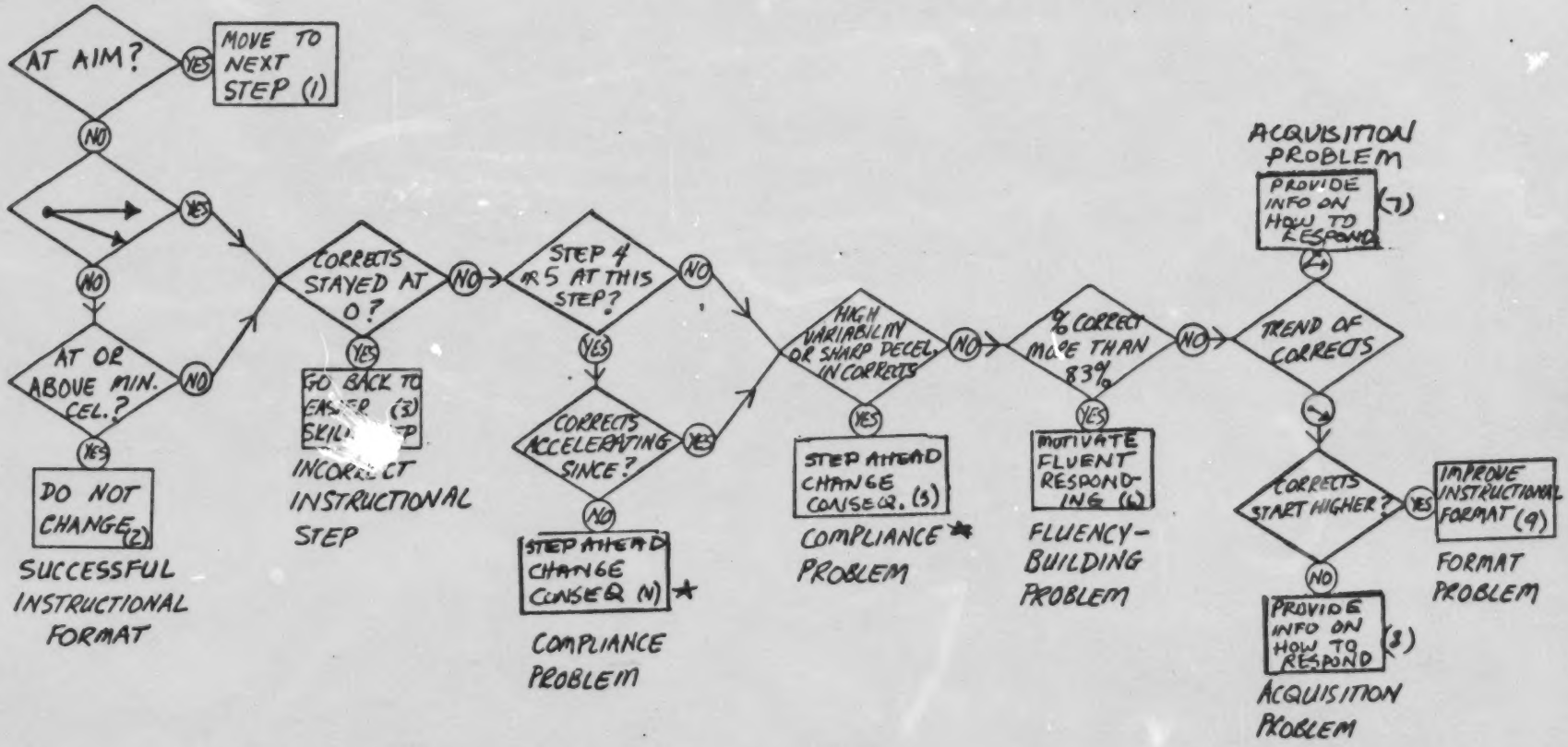
Strategies for Compliance Problems

1. Move to a more difficult skill level. Are you sure this skill level is the correct one? Are your criteria too high? Do you require a lot of days at criteria? Is the student bored?
2. Change or add a motivating consequence for correct/fluent performance.
3. Change the schedule for consequation of correct responses to avoid satiation.
4. Institute a response cost procedure (Gain for correct/fluent, lose for error/disfluent).
5. Eliminate completing consequences.
6. Add a time limit for no responses/change or add a motivating consequence for no responses and for errors (Caution: parental/guardian permission advised prior to implementation of aversive, negatively reinforcing or punishing consequences).
7. Institute "all day" procedures for compliance.
8. Avoid: moving to an easier skill level; repeating the instructions; coaxing or prompting the response; providing assistance; completing the response yourself; threatening the student; warning the student.

INSTRUCTIONAL HIERARCHIES RESEARCH PROJECT

University of Washington

Norris Haring, Principal Investigator



EXPERIMENTAL RULES FOR USE WITH MINIMUM CELERATION

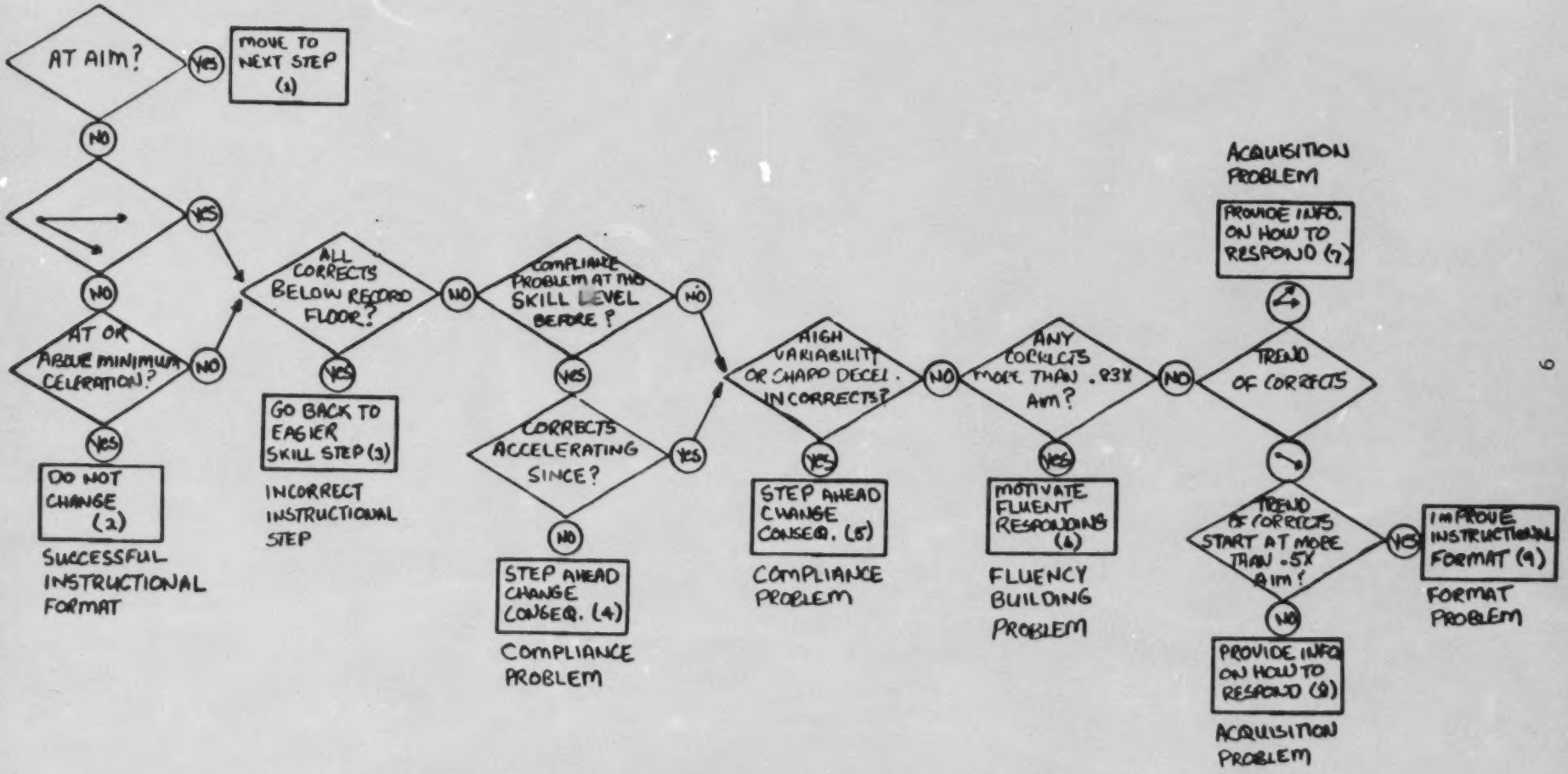
ACCELERATE RATE OF RESPONDING

Figure 2

INSTRUCTIONAL HIERARCHIES RESEARCH PROJECT

University of Washington

Norris Haring, Principal Investigator



ACCELERATE DURATION OF RESPONDING

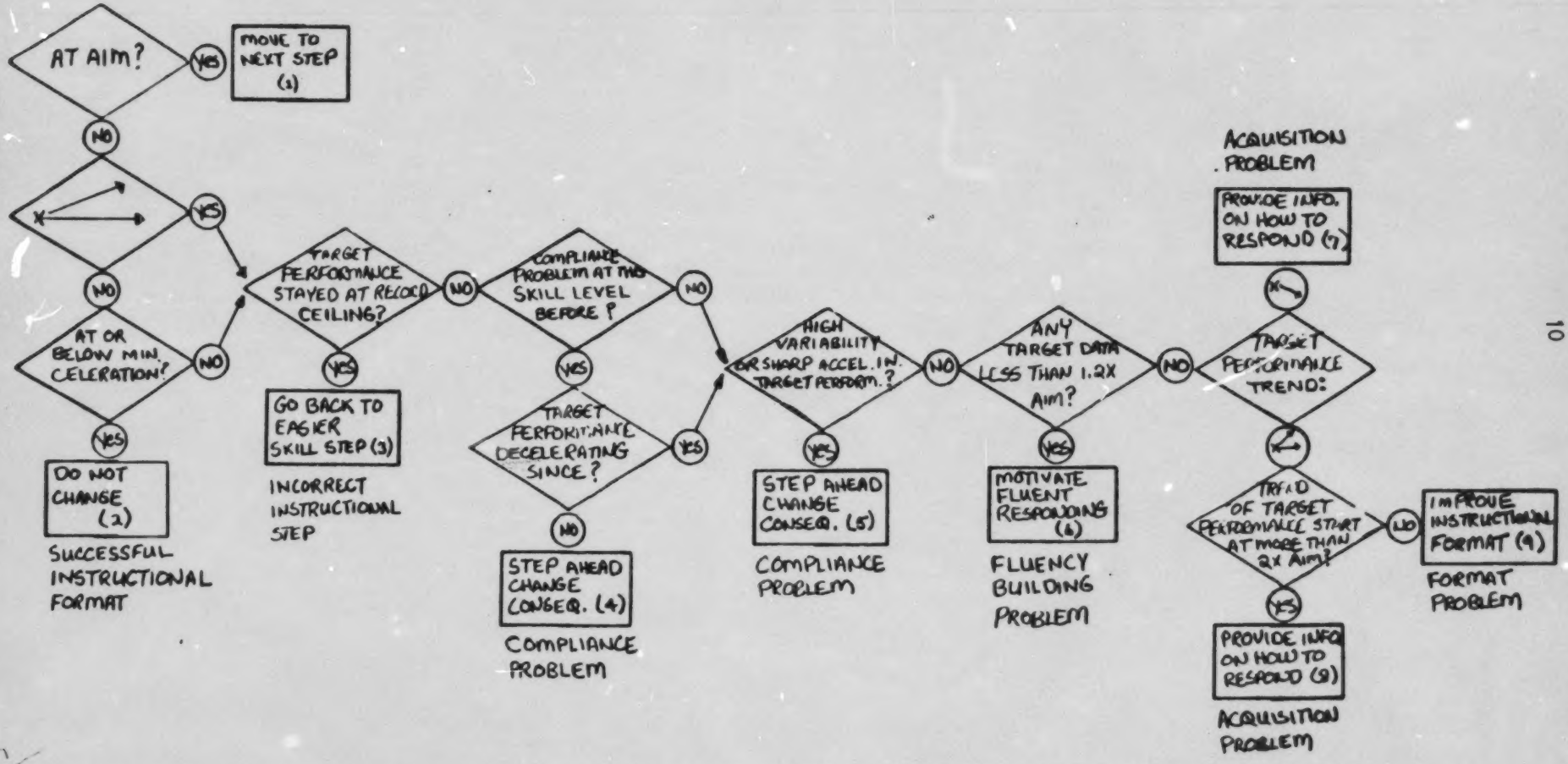
EXPERIMENTAL RULES FOR USE WITH MINIMUM CELERATION

Figure 3

INSTRUCTIONAL HIERARCHIES RESEARCH PROJECT

University of Washington

Norris Haring, Principal Investigator



DECELERATE LATENCY AND DURATION OF RESPONDING

EXPERIMENTAL RULES FOR USE WITH MINIMUM CELERATION

Figure 4

II

Fifth Project Year

Introduction

Activities for the fifth project year were designed to provide information on two main questions: 1) Would the decision-rules prove useful to teachers and therapists in public school situations? 2) What type of training that would best communicate the decision-rules? During the first years of the project, cooperating teachers and therapists worked closely with members of the research staff and received extensive training on the application of the procedures to their pupils and instructional situations. Since such training would not be available outside of the research project, fifth year activities involved training a number of teachers in the use of the decision-rules, using typical training models only--workshops, large groups, small groups, individualized instruction, and the simple availability of textbooks.

The effectiveness of the training was measured by the subjects' ratings of the training and of their attitude toward the decision-rules following training. Training effectiveness was also measured, however, by whether or not the subjects actually adopted the decision-rules for use in their classrooms. It was hypothesized that in addition to the effectiveness of the training, adoption of the decision-rules would depend on the nature of instruction and evaluation practiced by the subject; if current practices needed to be extensively modified in order to apply the decision-rules, we expected it would be less likely that the teacher would adopt the procedures. However, if teachers did adopt the decision-rules, it would suggest that the procedures could be used by teachers outside of the more controlled research applications of the last five years.

Data on the progress of pupils in instructional programs conducted by teachers who adopted the decision-rules would provide information on the impact of the decision-rules on pupil progress and on the effectiveness of teacher decisions. Those data would help determine if the results from the first project years were unduly influenced by the frequent contact with research staff members or were limited to the populations of teachers and pupils who cooperated in previous project years.

Most research data during the fifth year were gathered using questionnaires. The use of questionnaires imposed a dependence on the goodwill of subjects to return the questionnaires through the mail and meant that at least some questions would only be answered with indirect data (subjects' ratings) rather than on the basis of direct performance data. Many teachers applying the decision-rules did, however, share actual pupil progress data, thereby strengthening the basis for most of the conclusions reached.

Site Selection

There were several factors involved in the selection of sites for replication activities. Since much of the success of the effort would depend on cooperation, sites with history of cooperation with the University of Washington were considered first. Secondly, the feasibility of providing training and follow-up to the sites considered. Since it was felt that administrative support for the utilization of the experimental procedures was important, we also considered the likelihood of that support for materials, release time for training and for social support or praise. We were also interested in working both with teachers who had previous training in Precision Teaching and at least some who had not.

After some deliberation, initial contact was made with the following persons: Dr. Bill Tilley (Seattle Public Schools), Dr. Stillman Wood (Olympia Public Schools), Dr. Wayne Sailor (San Francisco State University), Mr. Carl Binder (Fernald School, Boston) and Ms. Val Lynch (Center for Inservice Training and Program Development, University of Washington). Dr. Sailor recommended a school for which he and his staff had provided training. When contacted, the administrator of this school was willing to participate, but later did not respond to letters or calls. Arrangements to work with each of the other sites were successful (see individual Site Reports for details).

In Seattle, Dr. Tilley agreed to continue the cooperative arrangement initiated during the fourth project year, and suggested that project staff work individually with building principals in identifying potential subjects. Since Seattle Schools, and the Special Education Department in particular, have a long history of involvement with the University of Washington, and since Precision Teaching advocates were formerly found in the Washington State Office of Public Instruction, it was expected that a majority of consenting subjects would have had previous training in Precision Teaching techniques.

Dr. Stillman Wood, Director of Special Services for the Olympia School District, has long advocated and supported the use of Precision Teaching procedures in that district. He was eager to participate, especially since his teaching staff were requesting training in decision-making procedures. Dr. Wood introduced us to the two advisors who provided direct supervision, support and data review for teachers of the severely handicapped in the district. Dr. Wood, and the advisors (plus the advisors for the other special education teachers in the district) were trained in the application of the experimental procedures prior to the initial meeting with potential teacher subjects. In fact, 6 of the 7 consenting teachers, and 2 of the 4 therapists reported previous training in Precision Teaching.

Mr. Carl Binder, of the Behavior Prosthesis Department of Fernald School in Boston, had been trained in the use of Precision Teaching by Dr. Ogden Lindsley. As a result of his interactions with various teachers throughout the New England area, both in preservice and inservice consultations and training, Mr. Binder had developed an informal "sharing" group of Precision Teachers in the New England area. Mr. Binder writes a monthly open letter, "Data Sharing Newsletter", and conducts monthly data-sharing sessions for teachers in the immediate Boston area. He also keeps in touch with teachers via telephone and mail contacts. Mr. Binder agreed to act as an intermediary between the IH project and those teachers. He sent a list of potential subjects, which the IH project then contacted. The IH project sent Mr. Binder Handbooks for consenting subjects. Mr. Binder distributed the Handbooks, and agreed to provide any follow-up assistance requested.

Ms. Valerie Lynch is the project coordinator of both the Center for the Severely Handicapped and the Western Region Inservice Training Center, two grants funded by the U.S. Office of Special Education. With the support of the Washington State Office of the Superintendent of Public Instruction, and the Area of Special Education, College of Education of the University of Washington, the staff of those two projects, under the auspices of the Center for Inservice Training and Program Development (CITPD), provided two separate training workshops for personnel working with the severely and profoundly handicapped. In general, school districts were invited to send an "Interdisciplinary Team" (teacher, administrator, a member of a support profession, therapist, nurse, and another teacher or member of a support profession) to one of the two workshops. Each team contracted with the CITPD to attend the Summer Workshop, and to develop program goals and objectives based on a needs assessment

carried out by CITPD staff. The CITPD then provided the initial training and follow-up designed to accomplish the individual objectives for each project site. At the three week workshops held in Seattle, participants generally spent half of each day attending didactic sessions on a variety of topics (including a modified Precision Teaching approach) and another part of the day in supervised practica with severely and/or profoundly handicapped pupils. With the cooperation of Ms. Lynch, participants in those two workshops were invited to become subjects in the Instructional Hierarchies Project.

The initial differences among the sites in the areas of estimated direct administrative support for the use of procedures, the number of subjects with a prior training in Precision Teaching, and the nature of the training and follow-up provided to each site are shown in Table 2. Together, consenting subjects at the sites were employed in a total of 18 public schools (of which 12 schools serve both handicapped and nonhandicapped pupils) in 13 different school districts and 7 private day or residential schools and 3 State Residential Schools.

Table 2

INITIAL DIFFERENCES BETWEEN SITES

Site	Estimation of Administrative Support for use of Procedures	Percent of consenting Subjects Reporting Previous Training in Precision Teaching	Nature of Training Planned	Nature of Follow-up Planned
Site 1	Varied from school to school; high support available from Project Intermediary	77%	Textbook Model: Subjects previously trained in Precision Teaching by Project Intermediary. Project provides textbook for use of decision-rules.	Follow-up available from Project Intermediary and research staff
Site 2	Administrators supported participation in CITPD Workshop.	16%	Large Group Model: Intensive training in educational technology related to education of sph pupils, including use of modified Precision Teaching procedures provided to all participants by CITPD. Three large group sessions on use of decision-rule procedures provided by IH Project.	Follow-up provided by CITPD staff with input from IH Project
Site 3	Administrator required use of Precision Teaching techniques and provided inservice training and ongoing support.	73%	Small Group Model: Training in use of experimental decision-rules provided in small group session.	In person and telephone contact upon subject request
Site 4	General administrative support for procedures, little or no direct support within schools.	66%	Individualized Training Model: Intensive individual training of Precision Teaching procedures and experimental decision-rules provided by IH staff.	In person and telephone contact upon subject request.

METHOD

Subjects at each site were introduced to the project in different ways, although each received essentially the same information. Potential subjects of Site 1 were identified by Mr. Carl Binder, who provided names and addresses to the project. Participants in the Workshops conducted by CITPD (Site 2) were also identified by persons other than the IH staff or district personnel. The potential subjects in Sites 1 and 2 each received letters describing the project. In addition, the Workshop participants attended an oral presentation concerning the project. Potential subjects at Sites 3 and 4 were identified by the administrators of the districts involved, and attended a meeting with the research staff concerning the nature of the project. (Details of the meetings and copies of the letters and consent forms are provided in the individual Site Reports which follow the general report.)

A total of 122 potential subjects were contacted. Of these, 107 (88%) returned consent forms, signed or unsigned. Of those returned, 89 (83%) consented to participate. The general method employed by the project is outlined in the nine steps below. Differences among sites, and the exact nature of the questionnaires and other methods for data collection used, are described in succeeding sections of this report.

1. Consenting subjects provided background information concerning relevant teaching experineces and personnel demographics.

2. Consenting subjects from all sites, excepting Site 1, trained in the use of the IH procedures, and completed a questionnaire concerning their evaluation of the training.

3. Additional information requested by the subjects concerning the content of training was provided, at all sites except Site 1.

4. Each subject received the Handbook of Experimental Procedures.

5. Each subject received a questionnaire requesting their evaluation of the Handbook.

6. Each subject was asked whether or not they intended to use the experimental procedures with their pupils. Subjects who did not intend to use the procedures were asked for their reasons. This concluded their participation in the study.

7. Follow-up assistance for the implementation of the IH procedures and any other related material was made available to those subjects who decided to try the experimental procedures. Availability of that assistance was continued throughout the project.

8. After 4-6 weeks, subjects remaining in the study were asked to evaluate the effectiveness of the procedures, and to provide additional information. With subjects deciding to continue in the study, identical information was requested on a periodic basis in order to determine attitude change, if any. In addition, actual pupil performance data were requested of the subjects.

Subjects were free to withdraw from the project at any time, without penalty of any kind, and were free to leave any question or item unanswered on forms provided by the project. Every effort was made to keep the identity of participating subjects unavailable to their supervisors, in accordance with the provisions of the University of Washington's Rights of Human Subjects Committee.

In general, data were collected through the use of questionnaires, although pupil performance data were made available to the project by several subjects. Severe limitations are, of course, placed on research conducted through the use of data from questionnaires, and will be discussed in the "Data Collection" section of this report, as well as in the Results and Discussion sections.

Subjects

The subjects of the project were 69 teachers and 16 therapists[1] serving a total of 1,215 handicapped pupils. Although the experimental procedures were designed for use by teachers serving primarily severely and profoundly handicapped students, we found that classrooms usually included a mixture of handicapping conditions; most notably, moderately handicapped pupils were integrated with severely and/or profoundly handicapped pupils.[2] (The reported handicapping conditions of pupils served by the teachers and therapists are shown in Table 3). Pupils identified by their teachers/therapists as severely, profoundly or multiply handicapped constituted approximately 50% of the students (N=601), with the addition of the moderately handicapped pupils this total rises to about 74% (N=904) of the pupils reached by the consenting subjects. Each of pupils had the potential of providing information on the impact of the experimental procedures on pupil progress in instructional programs.

The ages of the individual pupils are not known, but the ages served by each teacher/therapist are shown in Tables 4 and 5. It is interesting to note that Sites 1 and 2, which served a much higher proportion of institutionalized students, included more classes serving mixed ages ranges (e.g., 6-22; 11-54) and, of course, adults, than did the two sites which were exclusively public school settings, Site 3 and 4. The age range served by the subjects was from 1 through 54.

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[1] Although not originally planned, three administrators asked to participate. The administrators were interested in teaching their personnel to use the procedures. The administrators from Site 2 decided not to do so following training, and the Site 1 administrator's teachers consented to serve as subjects themselves. Data from the administrators is not included in this section.

[2] Information concerning the number and type of pupils served was provided by the subjects on the Background Questionnaire. Research staff personnel did not attempt to verify that information in any way.

Table 3

HANDICAPPING CONDITONS OF PUPILS SERVED BY SUBJECT TEACHERS AND THERAPISTS

Subjects Teachers		Learning Disabled	Mildly Handicapped	Moderately Handicapped	Severely Handicapped	Profoundly Handicapped	Multiply Handicapped	Other	Total[1] Pupils
Site 1	N=27	2	9	36	93	56	9	38[2]	243
Site 2	N=23	10	25	33	85	42	7	2[3]	204
Site 3	N=7	0	7	23	18	14	0	0	62
Site 4	N=12	8	14	68	76	32	11	6[4]	215
Total	N=69	20	55	160	272	144	27	46	724
Therapists									
Site 2	N=12	29	49	118	60	46	4	76[5]	382
Site 3	N=4	3	17	25	44	10	0	10[6]	109
Total	N=16	32	66	143	104	56	4	86	491
TOTAL	N=85	52	121	303	376	200	31	132	1215

[1] Calculated from the numbers provided per category, usually corresponding to number served per year, but not always.

[2] 8 deaf/hearing-impaired and 30 autistic

[3] orthopedically handicapped

[4] 6 orthopedically handicapped

[5] 70 communication disorders, 6 orthopedically handicapped

[6] 10 communication disorders

Table 4

AGE GROUPS OF PUPILS SERVED BY TEACHERS

Pupil Age Group	Site 1	Site 2	Site 3	Site 4	TOTAL
Preschool: 2-6					
Classrooms	-	5	2	2	9
Pupils[1]	-	35	27	41	103
Elementary 6-12					
Classrooms	2	5	3	5	16
Pupils	19	61	23	39	142
Mixed 2-12					
Classrooms	2	-	-	1	3
Pupils	24	-	-	5	29
High school 12-22					
Classrooms	6	7	2	4	19
Pupils	68	76	13	127	284
Mixed 6-22					
Classrooms	1	3	-	-	4
Pupils	5	30	-	-	35
Adults 22+					
Classrooms	1	2	-	-	3
Pupils	4	18	-	-	22
Mixed 11+					
Classrooms	15	-	-	-	15
Pupils	134	-	-	-	134

[1]Calculated from the number reported served per year.

Table 5

AGE GROUPS OF PUPILS SERVED BY THERAPISTS

Mixed 1-2 years		
Therapists	-	2
Pupils[1]	-	75
Mixed 1-18 years		
Therapists	-	2
Pupils	-	49
Mixed 3-22 years		
Therapists	12	-
Pupils	405	-

[1]Calculated from the number reported served per year.

Class Size was computed from the number of pupils the teachers reported serving on an average day. The 69 teachers reported serving an average of 680 pupils per day, as compared with 750 pupils over the course of the school year. Differences in those totals may be attributed to absences, deaths, and placement or school transfers. On an average day, the mean number of pupils served by a teacher was 9.9 (range 2-50). Five of the 69 teachers each served more than 20 pupils per day. Two teachers are resource room teachers serving 20 and 50 mildly handicapped pupils, one teacher served 28 moderately handicapped pupils (ages 13-17) with one part time assistant, one teacher was involved in a team teaching situation with two other (non-subject) teachers serving 36 preschool children, and one teacher conducted a vocational training program based on a resource room model for 50 sph students. Excluding those five teachers, the remaining 64 teachers served 569 pupils per year, and 511 on an average school day, with a mean class size of eight (range 2-16). Class sizes for the different sites are shown in Table 6. The number of pupils receiving direct service from the 16 therapists totaled 529 per year, while the number per day was about 188 total (mean 11.8, range 5-20) (see Table 6).

Table 6

CLASS SIZE

	Teachers[1]	Pupils/Year	Pupils/Day	Mean/Day	Range
Site 1	26	226	198	7.6	2-12
Site 2	22	200	178	8.1	5-14
Site 3	7	63	59	8.4	6-12
Site 4	9	80	76	8.4	5-16
TOTAL	64	569	511	8.0	2-16

[1]Excluding teachers who team teach or who serve pupils in a resource room model.

Table 7

CLIENT LOAD

	Therapists	Pupils/Year	Pupils/Day	Mean/Day	Range
Site 2	12	405	148	12.3	5-20
Site 3	4	124	40	7,6,10,17	-
TOTAL	16	529	188	11.8	5-20

Previous Experience. All but two of the teachers had previous experience working with handicapped pupils, with a mean number of 4.7 years (range 1-22), and all of the therapists also had experience working with the handicapped, with a mean of 6.3 years (range 1-23). Experience of the teachers and therapists are shown for each site in Table 8.

Table 8

PREVIOUS EXPERIENCE OF SUBJECTS

Subjects		N with previous teaching experience	Years experience mean (range)	N with previous special ed. experience	Years experience mean (range)
Teachers					
Site 1	N=27	27(100%)	3.8(1-22)	27(100%)	2.9(1-7)
Site 2	N=23	22(96%)	5.8(1-28)	22(96%)	5 (1-21)
Site 3	N-7	6(86%)	6.7(1-13)	6(86%)	4.4(1-10)
Site 4	N=12	12(100%)	9.6(3-22)	12(100%)	8.3(3-22)
Total Teachers	N=69	67(97%)	5.7(1-28)	67(97%)	4.7(1-22)
Therapists					
Site 2	N=12	12(100%)	7.2(1-23)	12(100%)	6.9(1-23)
Site 3	N=4	4(100%)	4.3(1-8)	4(100%)	4.5(1-8)
Total Therapists	N=16	16(100%)	6.4(1-23)	16(100%)	6.31(1-23)

Assistance Available. Sixty-three of the 67 experienced teachers had some help in the classroom from one or more of the following: paid assistants, volunteers, student teachers or other personnel (e.g., parents). There were a total of 127 assistants, 38 volunteers, 55 student teachers and 77 other types of assistants; the mean number of people helping one teacher each week was 4.2 (range 1-22). On the average, teachers who received assistance had the equivalent of 47.3 hours of help per week (range 4-122 hours). The four teachers who did not have any assistance in the classroom served a total of 16 severely handicapped pupils, 8 moderately handicapped pupils and four profoundly handicapped pupils, with ages ranging from 12-54. (See individual site reports for more details.)

Nine of the 16 therapists had some assistance. A total of 16 helpers served those nine thearpists for an average of 39.3 hours per week (range 5-120). Four of the 12 therapists from Site 2 were without help, and three therapists from Site 4 did not have any assistance available.

Therapy Assistance Available to Classroom Pupils. Fifty-eight of the 69 teachers reported that therapists worked with at least some of their pupils each week, for an average of eight hours per week (range 1-40). The nine teachers who reported that no therapists were working with their students served a total of 110 pupils per year (15% of the pupils served by the teachers). Six of these nine teachers were from Site 1, and eight of the nine teachers served pupils older than 12 years.

Instructional Practices

Types of Instruction. All of the teachers conducted instructional programs designed to increase behavior, either by teaching new behavior and skills or by improving performance in skills and behaviors which the student had previously acquired and which included some opportunity for individual pupil responding. The majority of instructional time was spent in 1:1 situations, although only three teachers provided 90% or more of their instruction in that situation. The least amount of instructional time, as can be expected, was spent in group situations requiring unison responding, although individual responding in group settings was also used by most teachers. As a group, therapists conducted most of their programs in 1:1 situations, with three of the 16 therapists using this type 90% or more of the time (Table 9).

Table 9

TYPES OF INSTRUCTION PROVIDED BY TEACHERS

Individual Response Opportunities	Site 1	Site 2	Site 3	Site 4	Total
1. During 1:1 instruction					
% teachers who provide:	96%	100%	100%	100%	97%
Mean amount of instruction time:	53%	41%	55%	36%	46%
2. At natural occasions					
% teachers who provide:	77	91	100	92	88
Mean amount of instruction time:	41	26	21	31	35
3. In group settings					
% teachers who provide:	81	86	86	100	85
Mean amount of instruction time:	22	27	21	31	25
Unison Response Opportunities					
% teachers who provide:	26	55	29	25	36
Mean amount of instruction time:	8	16	15	7	13

Table 10

TYPES OF INSTRUCITON PROVIDED BY THERAPISTS

Individual Response Opportunities	Site 2	Site 3	Total
1. During 1:1 instruction			
% therapists who provide:	100	100	100
Mean amount of instructional tiem:	71	95	77
2. At natural occasions			
% therapists who provide:	67	25	56
Mean amount of instructional time:	11	5	10
3. In group settings			
% therapists who provide:	92	25	75
Mean amount of instructional time:	20	10	19
Unison Response Opportunities			
% therapists who provide:	42	-	-
Mean amount of instructional time:	6	-	-

Frequency of Instruction. The frequency of instruction conducted by teachers is shown in Table 10. Generally, most instructional programs were conducted at least once per day, although one subject reported conducting programs twice per week and eight conducted instructional programs three times per week. Therapists, on the other hand, usually conducted instructional programs twice a week (Table 11).

Pupil Response Opportunities. Most (67) of the subjects provided 15 or fewer response opportunities when they conducted instruction: 26% provided 1-5 trials, 17% provided 5-9 trials, and 32% provided 10-15 trials (Table 12).

Table 11

FREQUENCY OF INSTRUCTION

FREQUENCY	TEACHERS					THERAPISTS			TOTAL
Per Day	Site 1	Site 2	Site 3	Site 4	Total	Site 2[1]	Site 3	Total	
Natural occasions throughout the day	1	0	0	1	2	0	-	0	2
Two or more preset sessions per day	5	5	0	1	11	1	-	1	12
One preset session per day	17	13	5	8	43	2	-	-	45
Per Week									
Four preset sessions per week	1	0	2	-	3	0	-	0	3
Three preset sessions per week	3	3	-	2	8	1	1	2	10
Two preset sessions per week	-	1	-	-	1	5	2	7	8
One preset session per week	-	-	-	-	-	4	1	5	5

[1] One therapist "sees" pupils either one, two or three sessions per week.

Table 12

PUPIL RESPONSE OPPORTUNITIES PROVIDED DURING INSTRUCTION

Number of Response Opportunities	Site 1	Site 2		Site 3		Site 4	Total
Per Instructional Session		Teachers	Therapists	Teachers	Therapists		
1-5	8	6	3	1	0	3	21
5-9	0	5	3	1	2	3	14
10-15	12	10	3	2	0	4	31
16-20	2	0	2	1	0	2	7
20+	2	0	1	1	1	1	6

Evaluation of Pupil Performance

Number of Programs. Thirty-seven of the subjects collected data on 95-100% of their programs, and 18 collected data on 85-94% of their program (Table 13). Seven subjects collected data on less than 25% of their programs. Generally, teachers at Sites 1 and 4 seemed more likely to collect data on almost all programs than teachers at other sites.

Table 13

PERCENTAGE OF PROGRAMS ON WHICH PUPIL PERFORMANCE DATA COLLECTED

Percentage of Programs	Site 1	Site 2	Site 3	Site 4	Total
95-100%	21	9	6	3	39
85-94%	2	11	2	3	19
75-84%	1	3	1	1	6
50-74%	2	4	2	-	8
25-49%	-	2	-	2	4
10-24%	1	1	-	2	4
less than 10%	-	3	-	-	3

Frequency. Teachers collected data more often than therapists. Thirty-six teachers and three therapists collected data every time an instructional program was conducted. Twenty-seven teachers and four therapists collected data almost every time a program was run, and four teachers and four therapists collected data about half the time the program was run. Four therapists collected data for initial assessment purposes only.

Number of Trials. Thirty-two teachers and five therapists collected data on every trial when they collected any data at all. Ten teachers and one therapist collected data on all trials during a specified period of time. Other subjects collected data on only specific number of responses (Table 14).

Table 14

NUMBER OF PUPIL RESPONSES EVALUATED

Frequency	Teachers	Therapists
data collected on every trial	32	5
data collected on first trial only	3	1
data collected on last trial only	5	-
data collected on random number	6	4
data collected on probe trials only	6	4
data collected on all trials during specified period of time	10	1
mixed	7	-

Type of Data. Teachers generally preferred either accuracy data or rate data (Table 15), clearly ranking those two data types higher than the others. Therapists showed less of a clear cut preference, although six ranked behavior counts as the data type they used most frequently. Teachers of Site 1 and Site 3 showed a strong preference for rate data, while teachers from Sites 2 and 4 preferred accuracy data.

Use of Data. Forty teachers (60%) and four therapists (25%) graphed data (all teachers of Site 3, 22 of 27 of Site 1, 3 of 12 of Site 4 and 8 of 23 of Site 2). The four therapists who graphed data were from Site 3. All but two subjects had rules for use in making instructional decisions in at least some of their programs. Seventy-six had rules or criteria for determining when the pupil met the performance aim, and 81 had rules for deciding what to do after the pupil met the aim. Sixty used specific criteria in deciding when to move the pupil back to an easier skill level. Thirty-nine reported rules for deciding when to change instructional procedures. Surprisingly, 37 reported rules for determining what type of intervention to make when changing instructional procedures.

Planning. The 67 experienced teachers spent an average of 4.66 hours per week planning instructional programs (range 1-20 hours), while therapists spent an average of 2.63 hours per week (range 1-8 hours). The 37 teachers with training in precision teaching spent, on the average, 45 minutes more per week planning than the 30 teachers without such training.

Table 15

TYPES OF DATA COLLECTED BY SUBJECTS

Data type	Teachers			Therapists		
	N Use	N Ranked 1st	Mean Rank	N Use	N Ranked 1st	Mean Rank
Accuracy data	46	28	1.87	10	4	2.6
Rate data	49	24	1.86	9	1	2.55
Count of behavior	37	10	2.18	11	6	2.18
Count of trials	27	5	2.7	9	1	3.11
Levels of assistance	38	3	2.9	9	2	2.55
Other time-based data	38	0	3.47	9	1	3.88

Training and Follow-up

All subjects were provided information about the application of the experimental decision-rules. Subjects from Site 1 received only the Handbook of Experimental Procedures. Subjects from other sites were trained by project staff. Subjects from Site 2 were trained in a large group, Subjects from Site 3 were trained in a small group, and subjects from Site 4 received individualized training. The content of the training varied somewhat from site to site, based on some changes in the experimental procedures and according to subject request.

Content of Training

The decision-rules which were derived during the first four years of the project provided the basis for all training. All subjects were provided with descriptions of the prerequisites for using the decision-rules:

1) Provision of instruction designed to teach the pupil a new skill, or to improve the fluency of performance of a previously learned skill. The decision-rules are not designed for programs designed to decelerate behaviors.
2) Selection of a criterion for performance of the behavior. In some cases, it would be necessary for subjects to select both a terminal criterion performance level and a target date for reaching that criterion.
3) Opportunity for the pupil to respond individually to the instructional cues. Unison, or group responding, would not provide the data necessary for application of the rules. Further, it was recommended that the pupil have at least ten response opportunities per school day.
4) Collection of performance data. Subjects were encouraged to collect either rate, latency or duration data, although subjects from Site 2 were also taught by the CITPD staff during the workshops to use the decison-rules with percent correct data.
5) Graphing performance data for analysis on semilogarithmic charts, either the standard Behavior Chart used in "Precision Teaching" or a modification of that chart used for percent correct data.

Following training in the prerequisites, which varied considerably from site to site, subjects were provided information on the use of the rules. The procedures presented to Site 2 subjects were different from those provided to subjects at other sites. Site 2 subjects were trained prior to the conclusion of fourth year activities (June, 1979). Thus, they were provided rules based on "performance patterns", which entailed drawing lines-of-progress every six data days, and then using a flow-chart to select a strategy change. After the analysis of fourth year data, however, it was decided to integrate the "minimum 'celeration rule" (Liberty, 1972; White & Haring, 1976) with the experimental decision-rules. Thus, subjects of Sites 2, 3 and 4 received information on how to draw minimum 'celeration lines; drawing lines-of-progress only when the pupil fell three days below that line, and then using a flow-chart to select a strategy change (Figure 2-4). Subjects from Site 1 were later provided with the rules for use with minimum 'celeration. After training in the use of the decision-rules, subjects were provided information on the types of strategy changes recommended for each of the performance categories. Decision-rules for use with programs designed to accelerate duration (Figure 3) or decelerate duration or decelerate latency (Figure 4) of responding were mailed to all subjects upon completion of those rules.

The Handbook of Experimental Procedures consisted initially of the following information:

(1) Step-by-step directions for applying the decision-rules.
(2) The decision-rules for use with programs designed to accelerate rate of responding, and to accelerate percentage correct (Site 2 only).
(3) Lists of the strategies recommended for use.
(4) Descriptions required for application of the rules, including: drawing lines-of-progress, drawing minimum 'celeration lines, determining percent correct, determining high variability and determining sharp deceleration in corrects.
(5) Text descriptions of instructional formats and instructional strategies recommended for use as intervention.

Additional information added to the Handbook during the last year included:

(6) A description of the prerequisites for use of the decision-rules.
(7) A description of methods of collecting and charting rate, adjusted rate, duration and latency data.
(8) Rules for use with latency and duration programs.

Subjects who had completed training, and were still participating in the project, received the information in points 6-8 as part of the Handbook.

Type of Training

Subjects at sites 2 through 4 were trained according to different models. Site 2 subjects were trained in the use of the experimental decision-rules as part of a summer workshop conducted by CITPD. Participants attended didactic sessions and worked with pupils in supervised practica. The workshops were conducted for a total of 14 days over a 3 week period, usually lasting from 8 a.m. - 5 p.m. daily. Participants received university credit upon satisfactory completion of the workshops. All participants of the workshop attended a one-hour session in the application of the decision-rules with percent correct data, which included directions for applying the rules and drawing lines-of-progress for sample data. Subjects of the IH project attended two additional sessions, offered a total of four times, which included more detailed information on the application of the rules and the instructional strategies. Those sessions usually included opportunities for practice of the procedures (see the Site 2 Report for a complete description).

Site 3 subjects were trained in the use of the decision-rules in a small group training model, although subjects who missed one of the two sessions were trained in individual or small group "make-up" sessions (see the Site 3 Report for a complete description). Subjects at Site 3 were trained in two one-hour sessions, conducted after their pupils had left school for the day, during the Fall of 1979. Subjects practiced applying the rules for one, two or three practice examples only.

Site 4 subjects were trained in the use of the decision-rules in a individualized training model. These subjects met individually with a member of the research staff, who directed training toward specific example of programs within the subjects' classroom. Training sessions were scheduled at the subjects' convenience. Four or five thirty-minute training sessions were usually held with each subject.

No direct training was provided for subjects at Site 1. Each of those subjects was simply sent a copy of the Handbook.

Length of Training

The length of training time varied from site to site (Table 16). The amount of time spent on any one topic also varied. Subjects from Site 3 spent only a few minutes discussing methods for collecting and charting data, since those subjects indicated that those topics were familiar to them; subjects from Site 4 spent up to 1½ hours on the same topics. The training time for Site 2 shows the time spent in sessions conducted by the IH project, although approximately 15 hours were also spent during the workshop covering related areas (e.g., conducting programs, collecting and charting data).

Table 15

LENGTH OF TRAINING

Site	Training Model	Training Time in Hours/Subject
Site 1	Handbook Only (N=27)	0
Site 2	Large Group (N=31)	3.75 (N=14) 4.0 (N=17)
Site 3	Small Group (N=11)	2.0
Site 4	Individualized (N=12)	2.5 (1.92-3.38)

Follow-up

Information on the general application of the decision-rules and associated procedures was available to subjects of Sites 2, 3 and 4 following training. Those subjects were able to request follow-up when they completed the Presentation Response Questionnaire. The requested information was provided through individual meetings between project staff and the subject, or through telephone conversations. Follow-up information on the application of the procedures to specific programs was also available to all subjects who agreed to adopt the decision-rules with their pupils for a trial period. Follow-up information was available on request provided by Mr. Carl Binder to Site 1 subjects. Information was provided either via written communication, personal visits, telephone conversations or some combination of methods.

Data Collection

Data collection procedures were designed to provide information relating to the adoption of the decision-rule procedures by the subjects, the impact of the procedures on pupil performance and an estimate of their cost-effectiveness. Information relating to the adoption of procedures by subjects was collected through a series of questionnaires. Data on the impact of the procedures on pupil performance was provided by subjects who contributed pupil performance data and through subjects' evaluation of the procedures on questionnaires. Cost-effectiveness data were estimated by project staff for training and follow-up, and subsequently related to

overall impact. Each of the data collection procedures are described in the following sections.

Questionnaires

Questionnaires are clearly limited as a method of data collection. The major limitations are imposed by the type, construction, and sequencing of items on the Questionnaire, by the return rate, by the reliability of the data so collected, and by the subjective nature of any ratings provided by the subject. In order to minimize errors caused through the construction of questionnaires, field-testing procedures were used for the Background Questionnaire. However, since subsequent questionnaires were designed to follow training, and since field-testing populations and project time were limited, the other questionnaires were not field tested prior to their use with the total subject sample. In order to improve the return rate, subjects were prompted by telephone or mail to return questionnaires. The reliability of the information provided by teachers was not checked by project staff. In general, a standard 5 point Likert scale was used on items requiring subject ratings. The questionnaires were administered in the sequence described below. Subjects were free to not answer any item or questionnaire, and free to withdraw from the study at any time without penalty of any kind.

Background Questionnaire. Items on this Questionnaire concerned information about the pupils served by the subject, the assistance available to the subject, the educational background, instructional procedures and evaluation methods generally utilized by the subject.

A draft of the background questionnaires was prepared during the fourth project year and was field tested to determine if the questions were understandable, answerable, and resulted the information desired. The test population consisted of head teachers at the Experimental Education Unit of the University of Washington who volunteered to assist the project. Fifth year activities were not planned at this site, so that the participation of the teachers in the field test would not compromise other research activities. A third and final draft of the questionnaire was prepared in April 1979 incorporating revisions based on the results of twelve test subjects. A copy of the Background Questionnaire is included in Appendix I.

Background Questionnaires, along with the consent form and introductory letter, were distributed to all potential subjects. For 3 of the 4 sites, that material was given directly to potential subjects by research staff members. Materials were mailed to Site I subjects.

Presentation Response Questionnaire. With the Presentation Response Questionnaire subjects provided an evaluation of the training and were able to request follow-up information on specific topics. There were two major parts of the Questionnaire (Appendix I): "clarity of information presented", and "attitude toward the procedures". Both sections utilized a standard Likert scale and provided space for written comments. Minor changes were made in the questionnaire for some sites to reflect the content of training provided. The Presentation Response Questionnaire was administered to all subjects (except Site I) following the conclusion of training.

Handbook Questionnaire. The subjects' responses to the Handbook Questionnaire (Appendix I) provided feedback on the clarity of information presented in the Handbook of Experimental Procedures. Subjects were asked to respond to questions on nine specific content areas of the Handbook, and to make any comments or suggestions

regarding the Handbook in general. The questionnaire was mailed or given to subjects who had received a copy of the Handbook. Usually two weeks elapsed between the distribution of the Handbook and the distribution of the Questionnaire.

Trial Period Questionnaire. Following the initial consent for participation, the Trial Period Questionnaire (Appendix I) was the most important questionnaire as far as determining the willingness of the subjects to utilize the experimental procedures. Subjects who agreed to utilize the experimental procedures in the classroom provided information on the number of pupils and programs to which procedures would be applied and their estimation of administrative support. They were also given the opportunity to request follow-up assistance. For subjects who did not agree to continue their participation, several items requested the reasons for their decision. This questionnaire was distributed to subjects along with the Handbook Questionnaire.

Procedures Questionnaire. This questionnaire (Appendix I) was designed to provide information about the impact of the experimental procedures. There were five parts to the Questionnaire: pupils served by the subject; usefulness of the Handbook; general attitude toward the procedures; impact of the procedures; and decisions as to further participation and utilization of the experimental procedures. Changes in the subjects' attitudes about the procedures and the Handbook, for example, may be determined through comparison with their responses to similar items on the Presentation Response and Handbook Questionnaires. The Procedures Questionnaire was administered to subjects who agreed to continue project participation by utilizating the experimental procedures in their instructional programming. Subjects received the Procedures Questionnaire at the conclusion of the trial period described in the Trial Period Questionnaire or after six weeks, whichever came first. Subjects who selected longer Trial Periods, or who decided to continue project participation, then received a second Procedures Questionnaire after another six week period. Unfortunately, the conclusion of the project year prevented the distribution of additional Procedures Questionnaires, which could have been useful for monitoring continued changes in attitude and impact over time.

Pupil Performance Data

Subjects who adopted the decision-rule procedures were asked to provide copies of pupil performance data. If provided by subjects, data for each pupil and each program were analyzed to yield the following information:

(1) The type of data collected by the subject.
(2) The total number of calendar and data days included.
(3) Whether or not the subject applied the procedures appropriately.
(4) The number and types of curricular changes made.
(5) The number and types of instructional strategy changes made.
(6) The number of changes which were in accord with the rules and the number that were not in accord with the rules.
(7) The effect of the strategy changes on pupil performance for the first five days following an intervention (immediate increase or decrease in corrects or errors, and changes in direction or magnitude of trend).

The reliability of the data collected on pupil performance by teachers was not checked by project staff.

Cost Data

Cost data were estimated for training and for follow-up. In order to provide a basis for estimation, personnel costs were established according to the following salaries:

(1) A twelve month salary for a trainer was estimated to be $17,000, based on a salary structure provided by the University of Washington. An average 8 hour day for an average of 20 days per month was used to calculate the hourly rate of $8.85.
(2) Based on information provided by the Seattle Public Schools, an average special education teachers' salary was estimated at $18,754 for an 182 day contract, with the hourly rate calculated at $12.88.
(3) Cost of the Handbook on Experimental Procedures was calculated as $5.54 each, based on duplication costs only. The cost of additional material provided to the subjects on collecting and charting data (@ $.70), seconds/decimal conversion finders (@ $.12), and practice sheets for the application of the decision-rules (@ $.40) were calculated separately since those materials were not originally planned for inclusion in the Handbook.
(4) Total trainer and teacher costs were based on the length of training time and the hourly rate estimated for salaries.

Follow-up Costs. Costs for three different types of follow-up provided by project staff were calculated separately. Cost estimation for follow-up provided through telephone conversations included preparation time for the trainer, and trainer plus teacher salary costs for length of the conversation [(preparation time for trainer x hourly rate) + (length of call x trainer hourly rate) + (length of call x teacher hourly rate)]. Cost estimation for follow-up provided through personal visits included preparation time for the trainer, trainer and teacher salary costs for the length of the meeting, and the cost of any materials consumed during the follow-up [(preparation time by trainer x hourly rate) + (length of meeting x trainer hourly rate ÷ number of subjects) + (length of meeting x teacher hourly rate x number of subjects) + material cost]. Cost estimation for follow-up provided through written communication included preparation time for the trainer, typing cost, and materials cost, [(preparation time x trainer hourly rate) + (no. of pages typed x $.50) + materials].

Data Summarization

Information collected on the questionnaires was entered into a computer for summarization. Information from each item and each subject was coded individually. Data were entered via SOS[1] and summarized through the System 1022[2] computer programs. Reliability checks of a randomly selected 10% of the subjects were made to determine reliability of data entry. Errors in data entry were found on Background Questionnaire data, so each entry was rechecked. A second check on Background Questionnaire data indicated 100% reliability. Reliability checks for the remaining Questionnaires also showed 100% accuracy.

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[1]The software SOS program utilized was prepared by the Brookings Institution Computer Center (Version 23).

[2]The software SYSTEM 1022 (Version 113) utilized is copyrighted by The Software House, 1105 Massachusetts Avenue, Cambridge, MA., 1979.

RESULTS

Evaluation of Training

Subjects were asked to rate the clarity of training on a Likert scale from "confusing" (1) to "very clear" (5). All subjects who completed training responded. Mean ratings across sites are shown in Table 16. Subjects who received individualized training from Site 4 generally rated all areas as clearer in presentation than subjects from either the small or large group training sessions. Subjects with previous training in Precision Teaching (N=21) rated the training as less clear than did subjects without a Precision Teaching background (N=33). The overall rating was 4.3 for the first group and 4.5 for the second group. Therapists (N=13) rated each individual presentation topic as less clear than did teachers (N=38), although the overall rating was higher (4.6 for the therapists and 4.5 for the teachers).

Table 16

SUBJECTS' RATINGS OF CLARITY OF TRAINING*

Presentation Topic	Site 2 (Large Group)	Site 3 (Small Group)	Site 4 (Individualized)	All Subjects
General purpose of decision-rule procedures	4.3 (N=30)	4.5 (N=11)	5.0 (N=12)	4.5 (N=53)
Establishing instructional formats	4.3 (N=31)	3.9 (N=11)	4.7 (N=9)	4.5 (N=51)
Collect data	4.5 (N=23)	4.2 (N=11)	4.5 (N=12)	4.5 (N=46)
Chart data	4.5 (N=14)	4.6 (N=11)	4.7 (N=12)	4.6 (N=37)
Draw lines-of-progress	4.6 (N=31)	4.0 (N=11)	5.0 (N=12)	4.6 (N=54)
Use decision-rules	4.4 (N=31)	4.4 (N=11)	4.9 (N=12)	4.5 (N=54)
Remediation strategies	4.2 (N=31)	3.9 (N=11)	4.8 (N=12)	4.3 (N=54)
Overall	4.5 (N=30)	4.1 (N=11)	4.8 (N=12)	4.5 (N=53)

Attitude Following Training

Subjects were asked to rate a series of items in order to determine their attitude toward the experimental procedures following training. Subjects rated their general attitude toward the procedures on a five-point Likert scale from "1" (very unfavorable) to "5" (very favorable). Subjects who received individualized training provided more favorable ratings than subjects from other sites, but all mean ratings were above 4.2, and the overall mean was 4.38 (Table 17). No subject rated their general attitude as less than "3". Subjects rated their opinion as to the usefulness of the procedures in general on a five-point scale from 1 (not at all useful) to 5 (very useful). The subjects from Site 2, the large group, rated the usefulness higher than any other site (4.6), but all groups were similar (Table 17). No individual subject rated usefulness less than "3".

Subjects were also asked to rate the applicability of the procedures to their teaching situation ("1"= not at all applicable; "5"= very applicable). The mean ratings on applicability to their own situation were lower in many areas than the mean ratings for general usefulness (Table 17). Subjects from Site 2 (Large Group training) rated the procedures generally more applicable in their settings than did teachers from the other two sites. Several subjects rated the applicability of conducting daily instructional programs according to a consistent plan in their situations as "2". One person rated the applicability of charting data as "1", while all other individual subject rankings were "3" or above.

The mean ratings of the therapists were lower in all areas than these of the teachers. Therapists felt that conducting instructional programs on a daily basis was less applicable to their situation (therapist's mean rating was 3.6, teacher's mean rating was 4.6). Two of the lowest mean ratings shown in Table 17 are for the applicability of conducting instructional programs. If therapist's scores are separated from those of the teachers, however, Site 2 teacher's mean rating is 4.5, Site 3 teacher's rating is 4.7, and Site 4, where there were no therapists, remains at 4.8.

Teachers who reported previous training in Precision Teaching generally rated both their general attitude, the usefulness, and the applicability of the procedures higher than did subjects without such training. The mean rating of general attitude of subjects with Precision Teaching training (N=21) was 4.48, as compared with a mean of 4.18 for the "no precision teaching" subjects (N=33). This difference in mean ratings held true for all areas except charting. Subjects with Precision Teaching training rated charting as less applicable in their situation (4.23) than did subjects without Precision Teaching (4.48).

Subjects with assistance in their classrooms (N=45) found the procedures more useful and applicable to their situations than did teachers who did not have any assistance (N=8).

Table 17

ATTITUDE TOWARD PROCEDURES FOLLOWING TRAINING

Presentation Topic	Site 2 (Large Group)	Site 3 (Small Group)	Site 4 (Individualized)	All Subjects
General attitude toward procedures[1]	4.4 (N=31)	4.2 (N=10)	4.6 (N=12)	4.38 (N=53)
General usefulness of procedures[2]	4.6 (N=31)	4.5 (N=11)	4.5 (N=12)	4.56 (N=54)
Applicability to their situation[3]				
Overall	4.4 (N=31)	4.1 (N=11)	4.3 (N=12)	4.33 (N=54)
Conduct instructional programs	4.2 (N=30)	4.1 (N=11)	4.8 (N=12)	4.32 (N=53)
Collect performance data	4.5 (N=31)	4.5 (N=11)	4.8 (N=12)	4.57 (N=54)
Chart data	4.5 (N=31)	4.4 (N=11)	4.5 (N=12)	4.46 (N=54)
Use decision-rules	4.5 (N=31)	4.2 (N=11)	4.8 (N=12)	4.54 (N=54)
Use remedial strategies	4.6 (N=31)	4.2 (N=11)	4.8 (N=12)	4.55 (N=54)

[1] ranked on a five-point Likert scale, "1"= very unfavorable to "5"= very favorable

[2] ranked on a five-point Likert scale, "1"= very useful to "5"= not at all useful

[3] ranked on a five-point Likert scale, "1"= not at all applicable to "5"= very applicable.

Cost of Training

Subjects who received no training other than receipt of the Handbook presented the lowest training costs ($6.64/subject). Among subjects who received direct training in use of the decision-rules, the subjects trained in a small group of nine at Site 3 had the lowest per subject cost, at $35.15 per subject. This difference was probably due to the difference in length of training time between those subjects and subjects at other sites, although the trainer-subject ratio is also important (e.g., the cost for a subject trained individually at Site 4 for 1.92 hours was $54.66). (See Table 18.)

Table 18

TRAINING COSTS*

Cost Item	Site 1	Site 2		Site 3		Site 4	
Training ratio	none	1:17	1:14	1:9	1:1**	1:4**	1:2
Training time in hours	none	4.0	3.75	2.0	2.75	2.34	2.67
Trainer cost per subject @ $8.85/hr	none	$ 3.64	$ 3.92	$ 2.69	$ 24.34	$ 8.15	$ 14.02
Subject salary for training @ $12.88/hr per subject	none	$ 51.52	$ 48.30	$ 25.76	$ 34.65	$ 30.14	$ 34.39
Handbook & training materials	$ 6.89	$ 6.99	$ 6.99	$ 6.75	$ 8.10	$ 8.10	$ 8.10
Cost Per Subject	$ 6.89	$ 62.15	$ 59.21	$ 35.15	$ 67.95	$ 46.39	$ 63.16
No. subjects trained	27	17	14	11	2 6	4	2
Total trainer cost	none	$ 61.88	$ 54.88	$ 29.59	$142.26	$ 32.60	$ 28.04
Total subject salary	none	$ 875.84	$676.20	$283.36	$207.90	$120.56	$ 68.78
Total materials	$186.03	$ 118.83	$ 97.86	$ 74.25	$ 48.60	$ 32.40	$ 16.20
Total per training ratio	$186.03	$1056.55	$828.94	$386.65	$398.76	$172.27	$126.32

*excluding travel costs
**median per subject

Follow-Up After Training

Follow-up was provided to subjects following training (or following receipt of Handbook) at their request. Twenty-six of the 81 subjects (32%) completing training requested follow-up information: 4 of 27 (15%) at Site 1 (Handbook Only); 18 of 31 (58%) of Site 2 (Large Group); 2 of 11 (18%) of Site 3 (Small Group); and 2 of 12 (17%) of Site 4 (Individualized).

Follow-up for four subjects of Site 1 included seven telephone calls. Cost of these calls (excluding long distance charges) was $40.64. Follow-up to eighteen subjects of Site 2 included seven short, individual meetings following training sessions and twelve telephone calls. Cost of these follow-ups (excluding long distance and mileage charges) was $61.30. Follow-up to two subjects at Site 3 included two personal visits, at a cost of $14.34. Three phone calls to one subject and a visit to another subject at Site 4 were provided, at a cost of $6.14 (excluding mileage).

Evaluation of Handbook

Fifty of the 81 subjects returned the "Handbook Questionnaire" (62%), 63% of Site 1 subjects, 45% of Site 2 subjects, 73% from Site 3 and 92% from Site 4. Subjects rated the content of the Handbook of Experimental Procedures on a scale from "1" (Confusing) to "5" (Very Clear). As a group, the subjects tended to rate the text descriptions of the stages of learning and the instructional strategies related to them as more understandable than the decision-rules and the technical information on their application (Table 19). Subjects from the small group training rated the Handbook higher overall than subjects at other sites.

Therapists (N=5) spent a median of 2 hours reviewing the Handbook, as did teachers (N=44), and the mean median rating for the two groups was about the same (4.4 and 4.36, respectively). Subjects with a background in Precision Teaching rated the Handbook as less clear (4.27, N=32) than did subjects without such training (4.58, N=18), although those with training had a higher return rate (74% and 40%, respectively). Subjects who rated the procedures as most applicable (5) in their situation were more likely to return Handbook Questionnaires (N=17, 71%) and rate the Handbook higher (mean median rating 4.47) than those who rated the procedures as less applicable (N=16, return rate 53% and mean median rating of 4.38). Similarly, those who reported a very favorable attitude toward the procedures were more likely to return the Handbook Questionnaire (N=16, 70% return) and rate the Handbook as clear (mean median rating of 4.5) than those whose reported attitude was less favorable (N=17, return rate 53%, mean median rating of 4.35).

Table 19

EVALUATION OF THE HANDBOOK OF EXPERIMENTAL PROCEDURES*

Content	Site 1 Handbook Only	Site 2 Large Group	Site 3 Small Group	Site 4 Individualized	All Subjects
How to use decision-rules	4.29 N=17	4.38 N=13	4.75 N=8	3.82 N=11	4.29 N=49
Rules for Rate & Quick Reference for Use of Rules	3.67 N=15	4.29 N=14	4.29 N=7	3.64 N=11	3.94 N=47
Rules for % Correct Quick Reference for Use of Rules	3.0 N=10	4.29 N=14	4.71 N=7	--	3.97 N=31
Quick References for Intervention Strategies	4.65 N=17	4.36 N=14	4.63 N=8	4.27 N=11	4.48 N=50
Technical information for application (drawing lines-of-progress determining variability, etc.)	3.47 N=17	4.07 N=14	4.38 N=8	3.8 N=10	3.86 N=49
Text: Instructional Formats	4.65 N=17	4.57 N=14	4.5 N=8	4.18 N=11	4.5 N=50
Text: Acquisition	4.12 N=17	4.57 N=14	4.63 N=8	4.18 N=11	4.34 N=50
Text: Fluency-Building	4.47 N=17	4.29 N=14	4.71 N=7	4.18 N=11	4.39 N=49
Text: Compliance	4.38 N=16	4.5 N=14	4.75 N=8	4.45 N=11	4.49 N=49
Mean Median Rating	4.29	4.5	4.63	4.18	4.38
Time Spent Reviewing Median & Range	2.75 hrs 1-10 hrs	2.5 hrs .25-8 hrs	1.75 hrs .5-3 hrs	2.00 hrs .25-10 hrs	2.00 hrs .25-10 hrs

*All items were rated on a Likert Scale from 1 (Confusing) to 5 (Very Clear)

Adoption of Decision-Rules

The return rate for the "Trial Period Questionnaire" was 75% (61 of 81 returned), with 63% from Site 1, 52% from Site 2, and 100% from both Sites 3 and 4 returning this questionnaire. Of these 61 subjects, 44 (72%) agreed to adopt the decision-rules for a trial period.

The seventeen subjects who returned the questionnaire and decided not to adopt the procedures gave various reasons for their decisions.

(1) Nine subjects reported that they thought the procedures would take too much time. These subjects reported (on the Background Questionnaire) spending an average of 2 hours per week planning. Subjects who agreed to adopt the procedures, on the other hand, spent a mean of 4.6 hours per week planning. Two of these "no" subjects had no help during the week, and one subject had 6 hours of assistance per week. The five other "no" subjects had about the same amount of help per week (41 hours) as did the "yes" subjects who reported having assistance.

(2) One subject reported that the procedures were not applicable to her severely and profoundly handicapped pupils since "high response frequencies" were required for their implementation, and her pupils were not capable of such high rates (misinterpretation of procedures).

(3) Three subjects reported that the procedures were not compatible with their curricula.

(4) One subject reported that the procedures were not compatible with the type of instruction provided in his/her class. This subject conducted programs once per week.

(5) One subject, who also reported insufficient time to use the procedures, said that he/she was unclear how to apply the procedures, although this subject rated all areas as either clear or very clear following training, and did not request any follow-up.

(6) Three subjects gave personal reasons (i.e., unemployed) as reasons for not using the procedures.

The seventeen "no" subjects included ten teachers, 1 administrator and six therapists, while three therapists and 41 teachers agreed to use the procedures. Sixty-eight percent of the "yes" subjects and 76% of the "no" subjects reported that other teachers in their school were using the decision-rules, while 87% of the "yes" subjects and 76% of the "no" subjects reported that their administration supported the use of the decision-rules (Table 20). A comparison of the two groups of subjects on a number of other variables is shown in Table 20.

Table 20

COMPARISON OF SUBJECTS AGREEING TO ADOPT PROCEDURES

VS. SUBJECTS NOT AGREEING

Variable	Agree To Use (N=44)	Not Agree to Use (N=17)
Av. Class Size[1]	7.46 pupils	8.88 pupils
Subjects with assistance Mean hours per week	91% 41 hours	76% 38 hours
Teaching experience	3 years	4.9 years
Precision Teaching training	36% of subjects	41% of subjects
Conduct instruction at least once per day	80% of subjects	45% of subjects
Provide at least 10 response opportunities	59% of subjects	24% of subjects
Collect data on at least 85% of programs	82% of subjects	41% of subjects
Collect data every time program run	64% of subjects	18% of subjects
Use rate data ranked #1 data type	73% of subjects 41% of subjects	59% of subjects 18% of subjects
Use percent correct data ranked #1 data type	68% of subjects 43% of subjects	71% of subjects 19% of subjects
Graph pupil data	61% of subjects	41% of subjects
Mean Planning time	4.6 hours per week	3.00 hours per week
Mean ranking of training	4.52	4.5
Mean ranking of general attitude	4.55	4.18
Mean ranking of usefulness of procedures	4.55	4.6
Mean ranking of applicability of procedures	4.44	3.8

[1]Excluding those with classes over 20 pupils per day (7 teachers in "yes" column).

Actual Adoption of Procedures

Of the 44 subjects who agreed to use the procedures, 31 reported on the use of those procedures. The other thirteen subjects either failed to use the procedures or failed to report on their use. A comparison of those subjects who actually used the procedures (N=31) and those subjects who did not use the procedures (N=50) is shown in Table 21. The subjects who did not use the procedures included all subjects who completed training, including both those who did not return a Trial Period Questionnaire (N=20), those who returned a questionnaire but decided not to use the procedures (N=17), and those who agreed to use the procedures, but either did not do so, or did not report on their use (N=13).

Subjects trained individually (Site 4) showed the highest percentage of adoption, while subjects trained in the large group (Site 2) had the lowest rate (Table 22). However, the single most important variable in adoption may be previous training in Precision Teaching, and only 19% of the subjects from Site 2 reported such training.

Table 21

COMPARISON OF SUBJECTS USING DECISION-RULES[1] AND SUBJECTS NOT USING DECISION-RULES[2]

Variable	Used Decision Rules (N=31)	Did Not Use (N=50)
Pupils		
Total pupils served	343	1234
% learning disabled	3% of pupils	3% of pupils
% mildly handicapped	10%	8%
% moderately handicapped	16%	24%
% severely handicapped	41%	27%
% profoundly handicapped	17%	24%
% other	12%	10%
% moderate + severe + profound	74%	74%
Assistance		
subjects with help	93% of subjects	82% of subjects
average hours per week	49.4 hours	53 hours
range	4-122 hours	4-476 hours
Experience		
subjects with experience	97% of subjects	98% of subjects
years of teaching	6.03 years	5.57 years
range	1-22 years	1-28 years
special education years	5.53 years	4.52 years
% of subjects with Precision Teaching training	65% of subjects	40% of subjects
Profession		
teachers	97% of subjects	68% of subjects
therapists	3%	26%
(administrators)	0%	5%

[1] Subjects who agreed to use procedures and reported on their use (N=31).

[2] Includes subjects who did not return questionnaire (N=20), subjects who did not agree to use procedures (N=17) and subjects who agreed to use but did not use or report on use (N=13).

Type of Instruction	Used Decision Rules (N=31)	Did Not Use (N=50)
Mean Percentage of Instructional Time		
in requesting individual pupil responses in 1:1 settings	46% of instruction	53% of instruction
in requesting individual pupil responses at natural occasions	29% of instruction	22% of instruction
in requesting individual pupil responses in group settings	27% of instruction	18% of instruction
in requesting unison responding in group settings	3% of instruction	5% of instruction
Type of Instruction Used Most Often		
Percentage of subjects who spend more than 50% of time:		
in 1:1 settings	48% of subjects	54% of subjects
at natural occasions	19% of subjects	18% of subjects
in group settings	13% of subjects	11% of subjects
in unison responding	0% of subjects	2% of subjects
Subjects who mix types of instruction	19% of subjects	11% of subjects
Frequency of Instruction		
natural occasions, daily	3% of subjects	4% of subjects
twice a day	13%	14%
daily	68%	42%
four per week	6%	4%
three per week	6%	16%
two per week	3%	12%
one per week	0%	9%
Number of Pupil Response Opportunities During Instruction		
1-5 trials	29% of subjects	25% of subjects
5- 9 trials	10%	21%
10-15 trials	42%	32%
16-20 trials	13%	5%
20+ trials	6%	7%
10 or more	61%	44%

Planning		
mean hours per week	4.06 hours	4.18 hours
range	1-10 hours	1-20 hours
Percentage of Programs Collect Data		
95-100% of programs	52% of subjects	42% of subjects
85-94%	23%	21%
75-84%	6%	9%
less than 75%	19%	28%
Frequency of Collection Per Program		
each time conduct program	58% of subjects	39% of subjects
almost every time	35%	37%
less	6%	23%
Data Collection During Program		
every trial	35% of subjects	52% of subjects
all trials in time period	13%	37%
first and/or last trial only	16%	7%
Type of Data Collected*		
count of behaviors	55% of subjects	58% of subjects
count of trials	32%	47%
levels of assistance	45%	60%
accuracy (% correct)	71%	61%
rate	71%	63%
other time data	65%	47%
miscellaneous	10%	4%

*Subjects commonly collect more than one type of data.

Type of Data Most Often Used		
count of behaviors	13% of subjects	25% of subjects
count of trials	10%	7%
levels of assistance	3%	7%
accuracy (% correct)	42%	35%
rate	42%	23%
other time data	0%	0%
Graph Data	68% of subjects	40% of subjects

Rules Available			
when to step ahead--	all programs	58% of subjects	47% of subjects
	some programs	42%	44%
when pupil met aim--	all programs	71%	46%
	some programs	16%	42%
when to step back---	all programs	30%	33%
	some programs	30%	39%
when to change strategies--all programs		6%	18%
	some programs	47%	26%
what strategies to change--all programs		10%	14%
	some programs	29%	30%
subjects with some rules		100%	96%
subjects with all rules		35%	37%

Rating of Training	N=23	N=31
Overall	4.52	4.47
general purpose of procedures	4.7	4.3
data collection	4.5	4.3
charting data	4.7	4.5
draw lines-of-progress	4.65	4.52
use decision-rules	4.65	4.39

Attitude Following Training	N=23	N=31
general attitude toward procedures	4.57	4.23
usefulness of procedures	4.61	4.52
applicability to their situation		
overall	4.52	4.19
conduct instructional programs	4.74	4.0
collect performance data	4.83	4.39
chart performance data	4.83	4.19
use decision-rules	4.78	4.36
strategies	4.74	4.42

Request Help Following Training	52% of subjects	68% of subjects

Support	N=31	N=50
administrative support use of procedures	26% of subjects	40% of subjects
other teachers use procedures	90% of subjects	53% of subjects

Rating of Handbook	N=30	N=20
how to apply rules	4.2	4.5
rules	4.0	3.8
quick reference guides	4.5	4.5
technical content	3.7	4.1
establish instructional format	4.5	4.6
acquisition strategies	4.3	4.5
fluency-building strategies	4.4	4.5
strategies for compliance	4.7	4.3
median rating	4.4	4.35
time spent reviewing	2.86 hours	2.5 hours

Table 22

RATE OF ADOPTION OF PROCEDURES BY TRAINING MODEL

	Handbook Only	Large Group	Small Group	Individualized
Subjects trained	N=27	N=31	N=11	N=12
Subjects with previous Precision Teaching Training	78%	19%	82%	67%
Rate of return[1]	67%	58%	100%	100%
Agreed to use procedures	56%	35%	55%	100%
Actually used procedures[2]	30%	19%	55%	92%
Continue to use procedures[3]	87%	100%	83%	100%

[1]Return rate of "Trial Period Questionnaire", in which the subjects reported their decision to adopt or not adopt the procedures. Subjects who did not return the questionnaire are classified as "not adopting"

[2]Includes only those subjects who reported on use of the procedures. Calculated from the total subjects trained.

[3]Those subjects who reported that they planned on continuing to use the procedures following the conclusion of the project. Calculated from those subjects who acutally used the procedures.

Application of Decision Rules

The thirty-one subjects who reported on the use of the decision-rules applied the procedures in a total of 227 instructional programs with 82 pupils over a total of 391 weeks (Table 23). The age range of these pupils was 1-29, with the majority between 3-23. Most applied the procedures with a few of their pupils, although some applied decision-rules to at least one program for each pupil in their classroom. The highest proportion of pupils affected by the decision-rules were those taught by Site 2 teachers, who were trained in the large group (Table 23), while teachers who were trained individually applied the procedures to the fewest numbers of pupils.

Table 23

APPLICATION OF PROCEDURES

	Handbook	Large Group Training	Small Group Training	Individualized Training	Total
Subjects using decision-rules	8	6	6	11	31
Total pupils served	52	71	47	133	303
Pupils affected by decision-rules	13 25%	30 42%	17 36%	22 17%	82 27%
Programs	49	95	52	31	227
Total weeks Mean per subject	69 8.6	118 19.6	107 17.8	97 8.8	391 12.6

Subjects reported on the use of rate data in 72 programs, the use of adjusted rate data in 44 programs, the use of percent correct data in 42 programs, the use of duration per trial data in 30 programs, the use of duration per session in three programs and the use of latency data in six programs. Data types for the other thirty programs were not provided. Prior to training, thirteen of the thirty-one subjects (42%) stated that they most often used percent correct data. Of these, two collected percent correct data exclusively for the trial programs, eight collected time-based data only, and three collected a mixture of data types. Before training, eleven of the subjects (35%) stated that they most often used rate data, and these subjects applied the decision-rules in programs in which they collected time-based data. Six subjects reported that they preferred to use either a count of behaviors or a count of trials data type, but, during the trial period, they applied the decision-rules primarily in programs in which time-based data were collected.

The majority of subjects applied the minimum celeration procedure for use of the decision-rules (Table 24), although six subjects from Sites 1 and 2 who were taught both procedures also used the draw patterns procedure.

Table 24

APPLICATION OF DECISION-RULE PROCEDURES

Procedure	Number of Subjects Using
Minimum 'celeration procedure for time-based data applied to time-based data	23
Minimum 'celeration procedure for time-based data applied to percent correct data	3*
Draw patterns procedure for time-based data applied to time-based data	3
Draw patterns procedure for percent-correct data applied to percent correct data	3*

*One subject tried both procedures

Use of Handbook

Eleven subjects rated the Handbook as less clear during application of the procedures than prior to application, five subjects rated the Handbook higher during application, and thirteen subjects rated no change. The mean median rating of the Handbook prior to application was 4.48 and during application (on the first procedures Questionnaire) was 4.23 (Table 25). However, since the questionnaires differed, a comparison is not too useful, although the same scale was used. The questions on the "Procedures Questionnaire" asked subjects to rate individual parts of the technical information section separately, although these topics had been grouped under one heading on the "Handbook Questionnaire". This change was made in order to determine which areas of the Handbook needed major revisions.

Table 25

SUBJECTS' RATINGS* OF THE HANDBOOK DURING APPLICATION OF PROCEDURES

Content	First Report	Second Report	Third Report N=5	Fourth Report N=1
How to use decision-rules	4.48 N=29	4.0 N=11	4.6	5
Decision Rules and Quick-References Guides	4.58 N=29	4.64 N=11	4.8	4
Technical Information				
Drawing Lines of Progress	3.7 N=30	4.09 N=11	4.4	5
Determining Percent Correct		3.2 N=10	3.6	5
Determining Performance variability	3.31 N=29	3.73 N=11	3.6	5
Sharp Deceleration in corrects	3.62 N=29	4.2 N=10	4.2	5
Text: Instructional formats	4.3 N=30	4.18 N=11	4.2	4
Text: Acquisition	4.17 N=29	4.0 N=11	4.0	4
Text: Fluency-Building	4.07 N=30	4.0 N=11	4.4	4
Text: Compliance	4.47 N=30	4.46 N=11	4.8	4
Mean Median Rating	4.23 N=30	4.18 N=11	4.2	4.5

*Rated on a likert scale of 1 (unclear) to 5 (very clear)

Attitude Toward the Procedures

The attitude of the subjects toward the use of the decision-rules and the associated procedures was lower during application than prior to application (Table 26). Subjects rated their attitude toward the collection of performance data as most favorable, and toward drawing lines of progress as most unfavorable overall. The subjects who reported more than once (N=11) generally increased their attitude rating.

Table 26

SUBJECTS' RATINGS* OF THEIR ATTITUDE DURING APPLICATION OF PROCEDURES

Attitude Area	Prior to Application	During Application			
		First Report	Second Report N=11	Third Report N=5	Fourth Report N=1
Using procedures when programs are established	4.72	4.14 N=29	4.45	4.6	5
Collecting direct performance data	4.81	4.73 N=30	4.55	5.0	5
Charting performance data	4.86	4.43 N=30	4.36	5.0	4
Drawing minimum 'celeration lines	—	4.28 N=30	4.45	5.0	4
Drawing lines-of-progress	—	3.79 N=29	3.91	4.2	4
Using decision-rules	4.77	4.52 N=29	4.36	4.4	5
Using intervention strategies	4.72	4.48 N=29	4.0	4.4	4
Overall	4.59	4.36 N=30	4.09	5.0	5

*Rated on a Likert scale of 1 (unfavorable) to 5 (very favorable)

Planning Time

Prior to application of the procedures, the thirty-one subjects reported a mean planning time of 4.06 hours per week (range 1-10 hours per week). During the application of procedures, the group averaged 2.24 hours per week (range 1-5 hours) during the first reporting period. Of the thirty-one subjects, one subject reported an increase of 1 hour per week in planning time during the application of the procedures, and three reported no change in planning time. Twenty-six subjects reported a deceleration in planning time: eight reported decreases of one hour per week; five of two hours per week; five of three hours per week; four of four hours per week, and four of five hours per week.

Subjects were asked to estimate how their planning time during the use of the procedures compared with planning time prior to use. The subject that reported an increase also estimated an increase, and of the three subjects whose planning time remained the same, one estimated an increase, one a decrease and one correctly estimated no change. Of the 26 subjects whose planning time actually decreased, only three correctly estimated the decrease, while 10 estimated no change and 13 estimated an increase.

Eleven subjects filed a second report. The median hours planning for this group prior to application was 3 hours per week (range 1-10), at the first report it was 1 hour (range 0-5 hours) and, at the second report it was also one hour per week. Eight subjects reported no change between the first and second reports, two subjects increased one hour each, and one subject's planning time decreased by four hours per week.

Five subjects reported a third time. Two of these subjects reported no change in their planning time between the second and third reporting period, two subjects each reported an increase of one hour per week, and one subject reported an increase from 0 hours to two hours per week.

Impact on Pupil Performance

The impact of the use of decision-rules on pupil performance was determined by subjects' estimation of impact, and by analyses of pupil performance data shared with the project staff.

Subjects' Estimation of Impact

Twenty subjects, who applied the procedures in programs for 63 pupils, estimated that the use of the decision-rules accelerated pupil progress (Table 27), while seven subjects, with 12% of the pupils, estimated that they made no difference to the progress of the pupils. One subject, who applied the procedures with three pupils estimated that pupil progress was decelerated. Three subjects, working with six pupils, estimated that the decision-rules accelerated progress in some cases, but decelerated progress in others.

Table 27

SUBJECTS' ESTIMATION OF IMPACT OF PROCEDURES ON PUPIL PROGRESS

Estimation	Subjects	Pupils
accelerated pupil progress	65% of subjects 20/31	77% of pupils 63/82
made no difference to pupil progress	23% 7/31	12% 10/82
decelerated pupil progress	3% 1/31	4% 3/82
accelerated in some, decelerated in some	10% 3/31	7% 6/82

Analyses of Pupil Performance Data

Subjects who used the procedures were asked to share pupil performance data with the project. Nineteen of the thirty-one subjects shared data for a total of 51 pupils (62% of those affected by the procedures). Data for a total of 136 programs, 60% of the total, were provided (Table 28). All subjects from Site 3, the small group training, shared almost all of their data, while five of the eleven Site 4 subjects, who were trained individually, shared little more than half of their data (Table 28).

The charted data provided by the subjects were analyzed in order to determine problems subjects encountered during application of the procedures. The data provided by six of the nineteen subjects showed consistent errors in the application of the decision-rule procedures. These errors were of three major types: (1) failure to change when pupil did not meet the minimum 'celeration line for three consecutive days; (2) failure to correctly draw a new minimum 'celeration line after a change was made; (3) failure to draw lines-of-progress. Subjects who made serious errors usually made all three types of errors. Subjects who failed to change usually either changed

late or drew a new minimum 'celeration line instead of changing a strategy. Most late changes, and all cases where new lines were drawn, failed to accelerate pupil progress.

Pupil performance data, including those in which subjects failed to correctly apply procedures, were analyzed to determine the types of intervention strategies selected and their impact on pupil performance. An intervention was categorized as successful if it resulted in (1) an immediate step-up (increase) in the level of correct responding greater than x1.09[1]; or, (2) accelerating correct performance of at least x1.09 if previous performance was unchanging or decelerating, or, if previous performance was accelerating, a x1.09 improvement in acceleration; or, (3) in the case of error correction procedures an immediate step-down (decrease) in the level of error responding greater than x1.09 and a deceleration of error responding of at least ÷1.09.

Each intervention analyzed had a minimum of five data days both before and after the intervention. In cases where changes were step aheads in the curriculum, the success or failure of the change was not determined, since the results of such an analyses would depend in great measure on the suitability of the curricular steps and on the performance aims selected by classroom teachers. A summary of the pupil performance data is shown in Table 29. More detailed descriptions of the data are included in the individual site reports.

The success of the subjects' decisions to change instructional strategies ranged from 0% (when one change was made) to 100% (when nine changes were made). As a group, the nineteen subjects who shared data successfully remediated pupil progress 68% of the time remediation changes were made. Subjects from Site 2 were generally more successful than subjects from other sites. Subjects from Site 4 showed the lowest percent of success, 59%.

The strategies subjects actually implemented were compared with the strategies that were defined for each case through application of the decision-rules, to determine how often teachers actually implemented the suggested remediation strategies (Table 30). Teachers could, for example, apply the decision-rule procedures and determine that the rules suggested an acquisition problem, and that some strategy designed to provide information on how to respond should be implemented. The teacher could, however, choose instead to add raisins for correct responses. In such a case, the teacher would not be following a recommended strategy.

Subjects who generally used a recommended strategy (e.g., subject 5207) had higher success rates than subjects who used recommended strategies less often (e.g., subject 5404), although subject 5339 followed the rules four times, and pupil performance improved only twice. Overall, the subjects applied recommended strategies 60% of the time. Subjects from Site 2 applied the recommended strategies most often, and also had the highest percentage of successful decisions.

Pupil progress may be accelerated by use of the decision-rules under two conditions: (1) the pupil proceeds more quickly through the curriculum, taking fewer days to reach aim than without the use of the rules or (2) the frequency of remediation decisions decelerates or (3) the percentage of successful remediations accelerates. Both (2) and (3) above should also result in faster progress through the curriculum.

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[1] 1.09 was selected since it is the quantity of change that can be generally noted by visual inspection of the data; although all analyses were made using standard trend calculation procedures.

The pupil performance data were analysed in order to determine the possible impact of the procedures. Table 31 shows the percentage and number of step aheads, which show progress through the teachers' curriculum, and the percentage of successful remediation changes alongside the subjects' own estimation of the impact of the procedures. Four of the subjects who provided data on five pupils showed that in 265 days in thirteen programs their pupils did not advance a single curricular step. This includes 474 calendar days. During this time, only 8 changes were made in order to remediate performance. Those subjects estimated that pupil progress was accelerated. Those subjects either set extremely slow rates of acceptable acceleration for pupil performance, or else they failed to change strategies when pupil performance fell below the minimum celeration line.

Ten subjects with sixteen pupils made fewer than 10 changes each in their programs. Eight of these subjects estimated that pupil progress accelerated, including two subjects who did not make any changes. The rate of successful decisions for 4 of those 10 subjects cannot be determined, since they made no remediation changes. Three other subjects (5346, 5402 and 5502) made one decision each.

Nine subjects made more than ten changes each. The success rate for those subjects ranged from 33%-100%, with a median of 68%.

Estimations of the impact of the decision-rules cannot be checked in the majority of cases, since data on pupil performance both before and during the application of the decision-rules were not made available to the project. Data available from three subjects and an aide of one of the subjects does show pupil performance both before and during the application of the decision-rules (Table 31). These data suggest that the major impact of the decision-rules was to increase the number of changes, especially changes in instructional strategies for remediation of problems. However, the actual impact of the procedures on pupil performance cannot be determined by the data provided.

Accuracy of Decision-Rules

Notations made by the subjects of the types of intervention strategy changes they made were used to determine whether or not the change was in accord with the intervention strategies suggested by the rules. A change made in accord with the rule is a de facto prediction that the strategy will accelerate pupil progress. The number of times this prediction holds true and pupil progress does accelerate describes part of the predictive validity of the decision-rules. This prediction held true for 74 of 86 cases, using the definition of a successful impact described in the previous section (Table 33). Conversely, a decision to use a nonrecommended strategy would result in a prediction of pupil failure; again providing the opportunity to determine the predictive validity of the rules. The prediction of failure held true for 37 of 57 cases. Overall, the predictive validity of the rules held for 111 of 143 cases, or 77.6% of the time.

Table 28

SUBJECTS' APPLICATION OF PROCEDURES

	Handbook Only	Large Group Training	Small Group Training	Individual Training	Total
% Pupils for whom procedures were applied	25% N=52	42% N=71	36% N=47	17% N=133	27% N=303
Programs	49	95	52	31	227
Weeks per subject	69 8.6	118 9.6	107 17.8	97 8.8	391 12.6

Table 29

SUMMARY OF PUPIL PERFORMANCE DATA

	Handbook Only	Large Group Training	Small Group Training	Individual Training	Total
Subjects who shared data	63% N=8	50% N=6	100% N=6	46% N=11	61% N=31
Pupils on whom data made available	69% N=13	63% N=30	88% N=17	36% N=22	62% N=82
Programs on which data made available	63% N=49	51% N=95	87% N=52	55% N=22	60% N=227
Calendar days covered by graph	1757	3782	4690	645	10,874
Data days on graph	739	481	2319	281	3,820
Phases	102	140	336	38	616
Total changes	71	92	295	26	484
% step aheads	18%	59%	57%	69%	52%
% remediation	82%	41%	43%	31%	48%
Analysed Remediation Changes	34	35	79	7	155
% Successful remediation Changes of total remediation changes	71%	86%	71%	59%	68%
% Using suggested strategy of total remediation changes	58%	84%	55%	57%	60%
Predictability of decision-rules	65%	77%	85%	71%	78%

Table 30

COMPARISON OF SUCCESS WITH USE OF SUGGESTED STRATEGIES

Subject	Pupils	Remediation Interventions	% Successful Interventions	% Interventions Using Suggested Stragegies	Predictability of Rules
Site 1					
5302	2	22	68%	53%	60%
5321	4	6	83%	100%	83%
5339	1	4	50%	100%	50%
5346	1	1	100%	100%	100%
5347	1	0	—	—	--
Site 2					
5101	6	9	100%	60%	60%
5108	7	16	69%	69%	75%
5207	6	11	91%	91%	82%
Site 3					
5402	1	1	0%	0%	100%
5403	1	6	33%	50%	88%
5404	2	12	58%	55%	82%
5405	5	27	56%	56%	92%
5413	1	0	—	—	--
5414	3	48	61%	41%	82%
aide to 5414	4	10	90%	90%	80%
Site 4					
5502	2	1	0%	0%	100%
5503	2	3	100%	66%	55%
5504	1	0	—	—	--
5508	1	3	66%	66%	66%
5512	2	0	—	—	--

Table 31

PERCENT OF CHANGES IN CURRICULAR LEVEL
AND IN INSTRUCTIONAL STRATEGIES AND SUBJECTS' ESTIMATION OF IMPACT

Subject	Pupils	Programs	Data Days	Number Changes	Percent Step Aheads	Percent Remediation	Percent Successful	Subjects Estimation of Impact
Site 1								
5302	2	15	668	42	31%	69%	68%	Accelerated pupil progress
5321	4	6	134	7	14%	86%	83%	Accelerated pupil progress
5339	1	4	122	6	0%	100%	50%	Accelerated pupil progress
5346	1	4	55	1	0%	100%	100%	Accelerated pupil progress
5347	1	2	29	0	—	—	--	Accelerated pupil progress
Site 2								
5101	6	11	413	18	39%	61%	100%	Accelerated pupil progress
5108	7	25	838	43	63%	37%	69%	Accelerated pupil progress
5207	6	11	310	31	65%	35%	91%	Accelerated pupil progress
Site 3								
5402	1	1	18	1	0%	100%	0%	No difference to pupil progress
5403	1	3	138	14	43%	57%	33%	No difference in some, accelerated in some
5404	2	4	237	23	13%	87%	58%	Accelerated in some, decelerated in some
5405	5	12	540	74	61%	39%	56%	Accelerated pupil progress
5413	1	3	62	8	100%	0%	--	No difference to pupil progress
5414	2	8	513	89	46%	54%	61%	Accelerated pupil progress
5414 aide	3	14	811	86	77%	23%	90%	Accelerated pupil progress
Site 4								
5502	2	2	28	3	66%	33%	0%	Accelerated pupil progress
5503	2	6	120	17	76%	24%	100%	Accelerated pupil progress
5504	1	1	20	2	100%	0%	--	Accelerated pupil progress
5508	1	1	72	4	20%	80%	66%	Accelerated pupil progress
5512	2	2	41	0	—	—	--	Accelerated pupil progress

Table 2

PUPIL PROGRESS IN A PROGRAM BEFORE AND DURING DECISION-RULES

		Before Use of Decision-Rules			During Use of Decision-Rules			
Subject	Pupil[1]	Av. Days to Step Ahead	Remedial Interventions	Percent Success	Av. Days to Step Ahead	Remedial Interven-tions	Percent Success	Percent Follow Rule Suggestion
5321	1	38	0	—	—	1	100%	100%
	1	—	0	—	27	1	100%	100%
	2	31	0	—	—	1	0%	100%
	3	—	0	—	—	1	100%	100%
	4	41	0	—	—	1	100%	100%
	4	—	0	—	—	1	100%	100%
5403	1	—	0	—	43	4	0%	0%
	1	—	0	—	14	2	100%	100%
	1	11	0	—	24	2	100%	100%
5414	1	21	2	100%	8	2	100%	100%
	1	—	3	0%	17	6	66%	33%
	1	5	0	—	9	5	75%	75%
	1	17	8	33%	16	6	33%	33%
	2	—	1	100%	7	7	80%	80%
	2	—	2	0%	27	6	100%	50%
	2	10	0	—	35	2	0%	0%
5414	1	22	1	100%	8	3	100%	100%
aide	1	14	1	100%	12	0	—	--
	1	24	1	0%	13	0	—	--
	2	17	2	50%	12	2	50%	50%
	2	6	1	—	23	1	100%	100%
	2	8	2	50%	11	2	100%	100%
	3	5	0	—	9	0	--	--
	3	21	2	50%	20	2	100%	100%

Table 33

PREDICTIVE VALIDITY OF DECISION-RULES (N=144)

	Pupil Progress Actually Did Not Accelerate	Pupil Progress Actually Accelerated
Changes made in accord with a rule (prediction that progress will be accelerated)	8.3% (N=12)	51.7%* (N=74)
Changes made not in accord with a rule (prediction that progress will not be accelerated)	25.8%* (N=37)	13.9% (N=20)

*Concurrence of prediction and actual results indicates predictive validity: OVERALL 77.6% (111/143).

Continued Use of Procedures

Twenty-nine of the thirty-one subjects who used the procedures reported that they plan on continuing to use the decision-rules. One teacher who did not plan on using them was planning to work with mildly handicapped pupils, rather than severely handicapped pupils.

Cost Analysis

Costs for the subjects who applied the procedures run from a median of $13.45 for subjects in the "Handbook Only" group to $74.24 for the median cost of a subject in the "Small Group Training" (Table 34). However, calculating costs per pupil puts the higher cost at $23.45 for the subjects trained individually, since they worked with the fewest numbers of pupils. The median costs per program and per week are also highest for Site 4 subjects, who applied procedures for fewer programs. The median cost per program per week was lowest for Site 1 subjects, at 7¢, and highest for Site 4 subjects, at $4.69. However, costs will be decreased the longer the subject applies the procedures.

Table 34

SUMMARY OF COSTS FOR SUBJECTS APPLYING PROCEDURES

	Site 1 Handbook	Site 2 Large Group	Site 3 Small Group	Site 4 Individualized
No. of Subjects	8	6	6	11
Median Training & Follow-up Costs	$13.45	$ 66.87	$74.24	$ 68.54
Low	$ 6.89	$ 59.21	$60.39	$ 46.90
High	$23.88	$137.55	$95.04	$125.66
No. of Pupils	13	30	17	22
Median Cost Per Pupil	$ 6.89	$ 8.49	$15.15	$ 23.45
Low	$ 2.45	$ 8.04	$14.53	$ 20.94
High	$22.36	$ 69.42	$95.64	$ 75.02
No. of Programs	49	95	53	31
Median Cost Per Program	$ 1.59	$ 2.57	$ 6.05	$ 19.08
Low	$ .69	$ 1.91	$ 3.50	$ 12.45
High	$11.18	$ 34.71	$75.85	$ 75.02
No. of Weeks	91	118	71	97
Median Cost Per Week	$ 1.33	$ 4.08	$ 4.78	$ 6.61
Low	$ .63	$ 2.73	$ 4.01	$ 5.71
High	$ 3.73	$ 5.85	$15.84	$ 15.79
Median Cost Per Program/Week	$ .09	$ .23	$ .38	$ 4.69
Low	$ .06	$ .07	$ 9.48	$ 1.10
High	$ 1.86	$ 2.04	$ .18	$ 11.06

Precision Teachers

In order to implement the decision-rules in instructional programs, certain prerequisite conditions needed to be met. It was hypothesized that teachers whose instructional and evaluation practices embodied the prerequisite conditions would be more likely to adopt the procedures than those subjects whose pre-training practices embodied none of the prerequisite conditions. Subjects whose instructional and evaluation practices indicated that many of the prerequisites for use of the decision-rules were identified from information provided on the Background Questionnaires. These subjects conducted daily instructional programs, in which the pupil was given a minimum of ten response opportunities, and in which data were collected on every trial. These subjects collected data on 95-100% of their instructional programs, graphed their data, and used some decision-rules prior to participation in this study. The data collected by these subjects were usually time-based data: rate, latency or duration.

Subjects whose instructional and evaluation practices indicated that most of their current practices would need to be modified in order to use the decision-rules were also identified. Those subjects had no precision teaching training, conducted instructional programs at most three times per week, collected data approximately half the time they ran instructional programs, and preferred not to collect rate or other time-based data. These subjects also did not graph their data.

Twenty-one subjects were identifed whose instructional and evaluation practices were compatible with the use of the procedures. Of those, sixteen (76%) agreed to adopt the procedures and eleven (52%) actually reported on the application of the procedures. Eight subjects were identified as those who would require major modification of their existing procedures in order to apply the decision-rules. Of those, only one returned a trial period questionnaire, and none agreed to try the procedures.

DISCUSSION

We planned to evaluate the effectiveness of training models, as well as the effectiveness of the decision-rules, through an analyses of the impact of (1) the proportion of subjects from each site who actually adopted decision-rules, and (2) by the impact the rules had on pupil progress. Unfortunately, several factors prevented the collection of all of the data necessary for those evaluations: the low return rate on questionnaires, especially during the adoption of procedures; the fact that teachers share I only about 60% of the pupil performance data with the project; and the lack of "before" or preintervention data on pupil performance. Each condition could have been improved through a more careful management of contingencies. The subjects were required to complete training before they received a copy of the Handbook, and all but 8% did complete training. Most subjects were, as expected, eager to receive their copy, but, once they received their copy, participation dropped, and twenty-five percent failed to return the Trial Period Questionnaire. Participation continued to drop, with 28% refusing to try the procedures, and 30% who agreed to try did not do so, and finally, 39% did not want to share pupil data.

The Handbook might have been used as a potential reinforcer more effectively if subjects had "earned" sections of the Handbook throughout the project, instead of earning the entire book at the conclusion of training. Other available contingencies included: self-reinforcement by potential or actual improvement in pupil progress; reinforcement by discussion with research staff; self-reinforcement for learning new techniques and facing new challenges; and reinforcement by peers and/or administrators. Of those, only the potential reinforcer of "follow-up" could be controlled by the research staff. Additional information and assistance in the use of the decision-rules, and assistance in any other area requested by the staff, was promised only for subjects agreeing to employ the decision-rules on a trial basis. That contingency was not employed effectively at two sites. Three Site I subjects, in the New England area, adroitly managed to receive a total of six follow-up telephone calls by first agreeing to adopt the procedures, and after the follow-up, not using the procedures. They also received numerous phone calls requesting the return of "Procedures Questionnaires. Subjects from Site 2, the Summer Workshops, received follow-up assistance from staff of CITPD on a noncontingent basis. CITPD's follow-up included personal visits following the conclusion of the workshops, which the project's travel budget could not afford. Eight subjects from those sites received follow-up information without returning "Trial Period Questionnaire". When called to prompt a return of this questionnaire, those subjects asked for, and received, assistance on different programs in their classrooms. One subject at Site 4 also managed to receive follow-up without actually trying the procedures. Perhaps better management of the two contingencies available to the research staff--the Handbook and follow-up--would have improved the return rate on questionnaires, the rate of adoption of decision-rules, and the amount of pupil performance data shared with the project. Even with such poor contingency management, however, thirty-one of the original eighty-one subjects remained with the project, and nineteen subjects shared pupil performance data.

Effectiveness of Training Models

There are several different methods of estimating the effectiveness of the various training models. By far, trainee rating scales are the most common. Site 4 subjects, who received individualized training, gave the highest ratings to the training, while those subjects trained in a small group (Site 3) gave the lowest ratings. Since attitude toward the procedures is also important, it is interesting that subjects from

the individualized training model rated their attitudes as more favorable than the other sites in general attitude and in the applicability of various components, but that subjects from the large group workshop training rated the procedures as slightly more useful and applicable.

Another test of training is the amount of follow-up required in order to implement the procedures. The better the training, the less follow-up should be needed. Subjects from the "Handbook Only" group requested the least amount of follow-up, both before and during application of the procedures, while all but one subject from both the workshops and small group training requested follow-up. However, the data shared by participants indicates that perhaps 32% of all subjects applied the procedures incorrectly--more subjects should have requested technical assistance. Errors in application of the procedures were not remedied unless teachers asked for technical assistance. In most cases, assistance provided concerned instructional methods, rather than technical information on the application of the decision-rules. In cases where technical information was requested, it was only through a discussion of some related topic that the teacher realized a problem in application. In the majority of cases, the subjects were unable to recognize an error, and so did not ask for assistance. Errors in application of the procedures could have been prevented not only by improving the training and Handbook, but by requiring a technical follow-up session for teachers adopting the procedures. Of course, with so few contingencies available, such a requirement may have further reduced participation.

Ideally, teacher training should produce a demonstrable impact on pupil performance. The first step in achieving that impact is the adoption of the procedures by the teachers. The individualized training model produced the highest rate of use in the classroom (92%) while the large group training produced the smallest (19%). However, background variables such as previous training in Precision Teaching probably affected rate of adoption as much, if not more, than did the type of training the subjects received. The second step in such an evaluation is the number of pupils affected. Subjects from the large group training worked with the highest percentage of pupils (42%) while subjects from the individualized training worked with only 17% of their pupils. While a greater number of teachers may have agreed to try the rules in their classroom when individual training was provided, those same teachers actually tried the procedures with fewer children than those given less direct support initially. Most subjects trying the rules agreed that the procedures accelerated pupil progress, but the actual data required for a comparison of pupil progress before and during use of the decision-rules are not available. Overall, then, it is really impossible to determine which training model produced the greater impact on pupil performance.

Results suggest that perhaps training in a large group as conducted during this project will require a great deal of follow-up, and result in a low rate of adoption. Those that do adopt the procedures, however, will apply them to many of their students. Conversely, the project's small group training will produce a higher rate of adoption but affect fewer pupils. Individualized training will produce high ratings for training content, and high rates of adoption, but also affect only a small proportion of pupils. The "textbook only" model will require some follow-up, and produce moderate amounts of adoption that affect about half of the pupils in the classrooms involved.

Independent Variables Affecting Adoption

This study was not designed to test the relative importance of various independent variables in affecting rate of adoption. However, there are some major

differences between those subjects who adopted decision-rules and those who did not adopt them. Of primary importance is the fact that 65% of those adopting decision-rules reported previous training in Precision Teaching, while only 40% of those that did not use the decision-rules reported such training. That difference also shows up in related variables (e.g., frequency of instruction; number of pupil response opportunities; frequency of data collection, etc.).

Of secondary interest, a greater proportion of the teachers adopted the procedures than did therapists. Half of the therapists included in the study would have had to modify their instructional and evaluation practices considerably for the application of decision-rules, but half of the therapists were already using precision teaching techniques. Only one therapist, who had no previous precision teaching training, actually adopted the procedures. That may have been a result of the training, since therapists generally rated the individual topics as less clear than did teachers. In addition, their attitude toward the procedures following the training was less favorable than the teachers.

Subjects who requested additional information immediately following training were less likely to use decision-rules than those who did not request such help. On the other hand, there are several additional variables that may affect who asks for help and who does not ask.

Ninety percent of those subjects adopting the procedures thought that other teachers in their areas were using the decision-rules, while only 53% of the "no" subjects thought so. But more of the "no" subjects thought they had administrative support than did the "yes" subjects. This may suggest that peer participation is more of a potential reinforcer than administrative support.

If training designed to impact on teachers' use of decision-rules were again provided, the rate of adoption or behavior change on the part of teachers might be accelerated by including those teachers with previous training in Precision Teaching and by selecting teachers who work together. Modification in the training to include more examples of applications in traditional therapy situations might improve adoption rate by therapists.

A true cost-benefit analyses of the training is impossible, since one would have to assign a monetary value to improvement in pupil performance. Since we are unwilling to do so, we can only point out that the cost of the decision-rules may run as low as 7¢ per week per program. Costs could be substantially reduced by increasing the rates of adoption and of application to pupils and programs.

Effectiveness of Decision-Rules

The effectiveness of the decision-rules in accelerating pupil progress cannot be accurately gauged without data on pupil performance before the use of the procedures. Such data were not available to the project. However, the percentage of successful decisions made by the subjects participating in the project compares favorably with teachers who used the decision-rules in previous years.

Overall, the proportion of changes designed to advance the pupil through the curriculum was higher in the 5th year (Figure 5), but could, of course, be heavily influenced by the type of curriculum sequencing used by teachers. The fifth year subjects made slightly fewer interventions designed to remediate failing performance than in previous years, and they were much more successful in their decision making

than teachers who did not use decision-rules (Figure 6). All of the teachers who used decision-rules during the last three years of the project had a higher percentage of successful decisions than teachers who did not use such rules. However, the data indicate that the decisions have a higher chance of success if rule suggested strategies are implemented (Figure 7).

The decision-rules developed during the five year project show great promise in improving the success of teacher decision-making in instructional programs. The decision-rules are designed to facilitate pupil performance during the acquisition and fluency-building stages of learning. Those stages of learning can be identified from charted records of pupil performance. Certain types of instructional strategies have a high probability of accelerating learning if appropriately implemented during each stage. Remediation strategies designed to provide information on how to peform the desired skill or behavior are generally effective during acquisition, while consequences that motivate performance are generally more effective during the fluency-building stage of learning. Decision-rules that can be applied to pupil performance data may not only reduce the amount of planning time spent by a teacher, but will increase the effectiveness of teacher decisions. These results have the potential of improving the education of the severely handicapped. The decision-rules can be taught to classroom teachers with a minimum of background skills in relatively short periods of time, from 2 to 4 hours. These results are very encouraging, and indicate the potential impact of the use of decision-rules in improving the education of the severely handicapped.

Other results, however, give cause for concern. Although not initially included, the decision-rules now include a rule saying that if the pupil is at aim, it is time to move to the next step. This rule had to be included because many teachers did not set aims for their programs, and/or did not move the pupil to the next step once an aim was reached.

Another cause for concern is the low rating given by fifth year teachers of the applicability of conducting daily instructional programs. Sufficient evidence has accumulated on the need for frequent instruction to insure that skills are acquired, mastered and maintained. Why aren't teachers ready to conduct daily programs?

This project was not designed to intervene in the curriculum offered by the teachers. However, the list of behaviors targeted for intervention has not changed too much over the years. The behaviors targeted by the fifth year teachers were similar to those targeted by teachers five years ago, and the lists (provided in the site reports) do not indicate that the programs are teaching those behaviors that would promote independent community or home functioning, despite the call for such programs in recent years. The teachers who participated in the study are well trained and well-meaning, yet they continue to teach skills that have seemingly little relevance to community-based functioning.

Another problem lies in the collection of data. Despite the fact that the collection of at least some data is mandated by P. L. 94-142, several teachers reported that they collect such data on fewer than half of their programs. Data collection and charting is often promoted as a routine task for teachers, rather than one that can decrease their planning time and improve pupil performance. The development of data-based decision-rules can help teachers improve the success of their instruction,

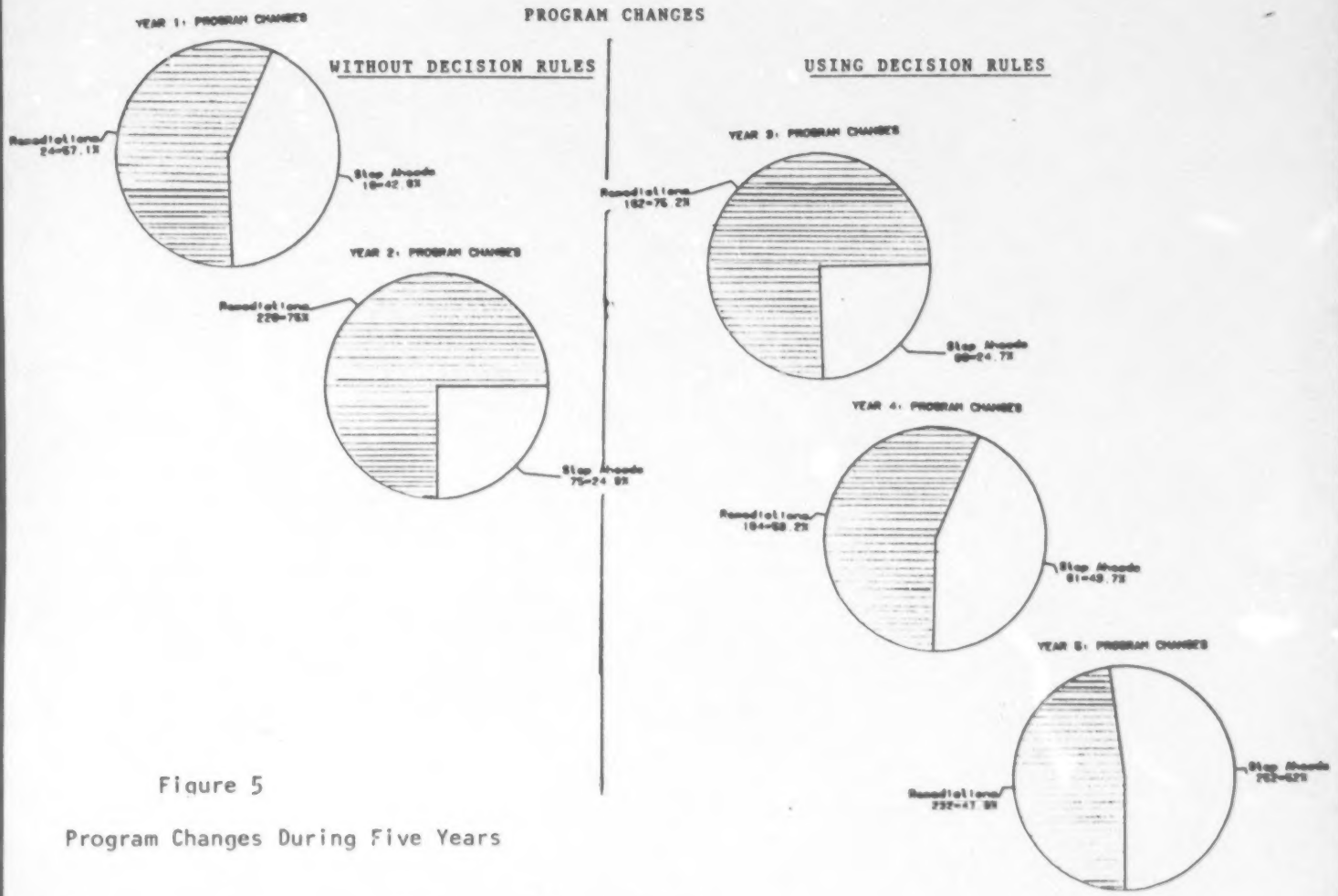

Figure 5

Program Changes During Five Years

shaded area = decisions to remediate pupil performance
unshaded area = decision to move to next instruction step

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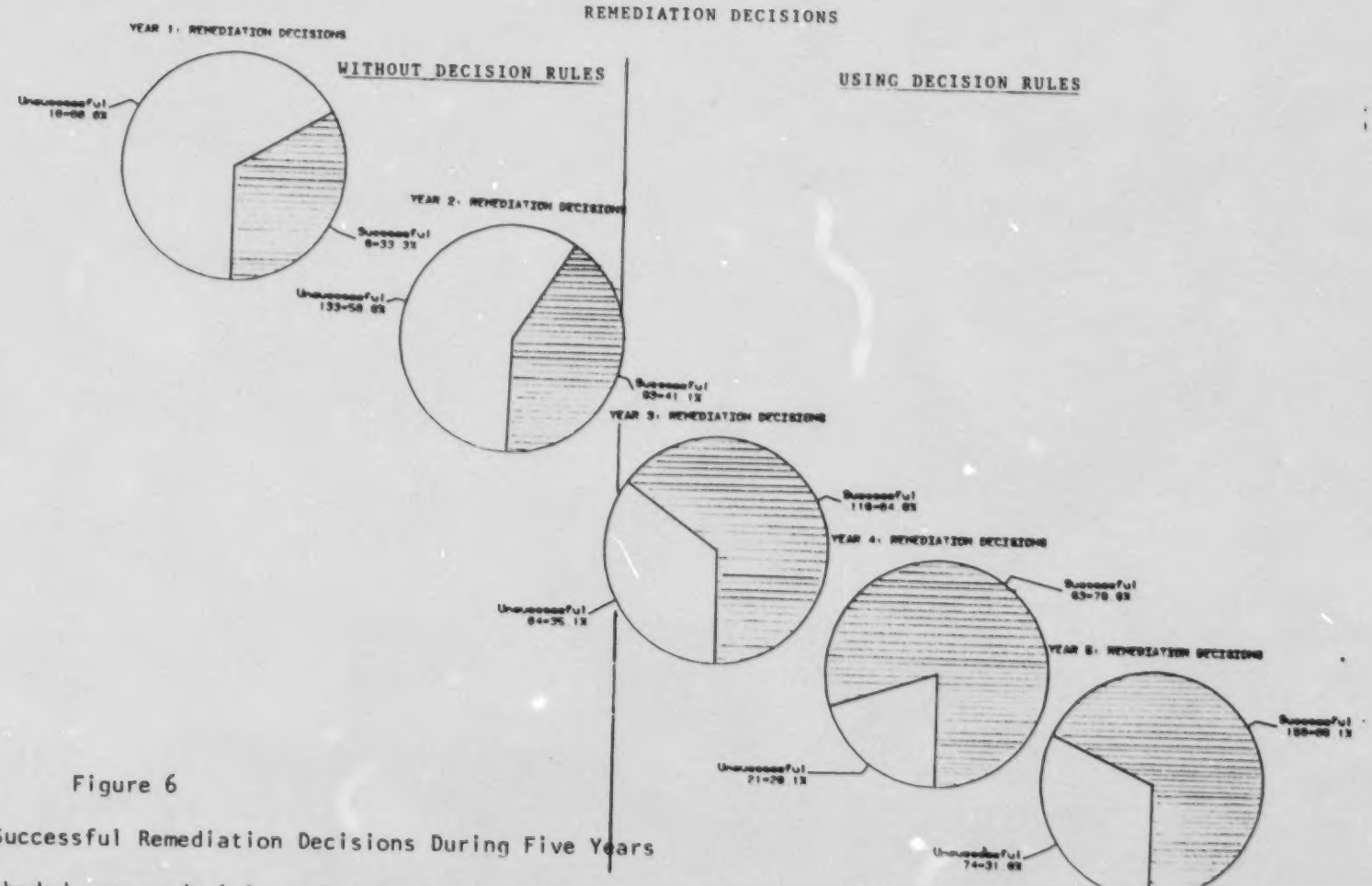

Figure 6

Successful Remediation Decisions During Five Years

shaded area = decisions that improved pupil performance
unshaded area=decisions that failed to improve pupil performance

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but we see little hope for the implementation of decision-rules until such time as teachers are willing and ready to conduct instructional programs with specific performance aims and to collect and chart their pupils' performance data. Even then, the full impact of decision-rules will not be felt until they are applied to programs designed to teach functional skills to the severely handicapped.

Figur

COMPARISON OF SUCCESSFUL DECISIONS WITH USE OF SUGGESTED STRATEGIES

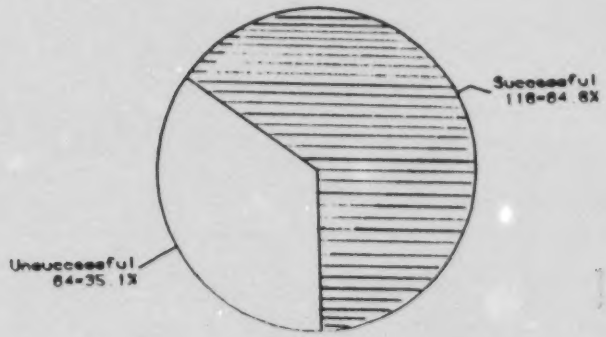
REMEDIATION DECISIONS

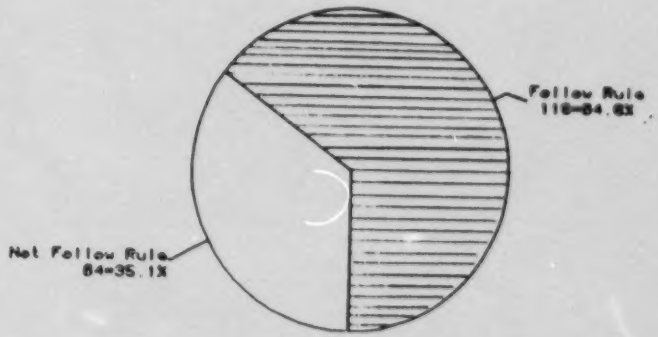
shaded area = improve pupil performance
unshaded area = fail to improve

USE OF STRATEGIES

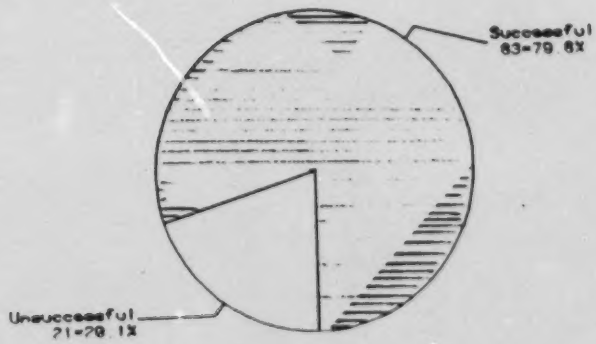
shaded area = use of strategy recommended by rule
unshaded area = use of other strategy

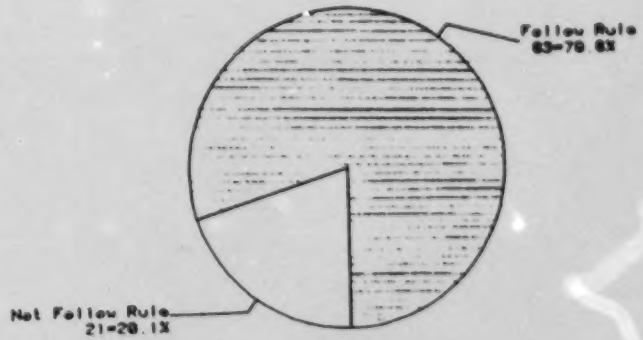
YEAR 3



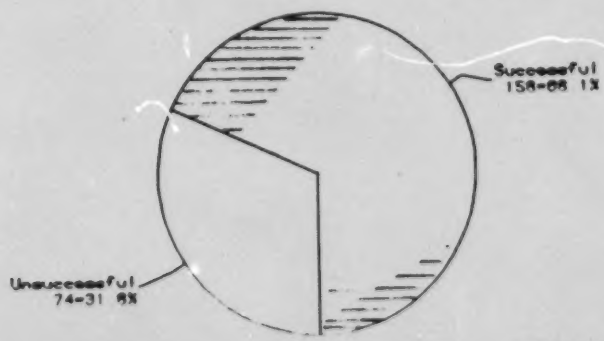


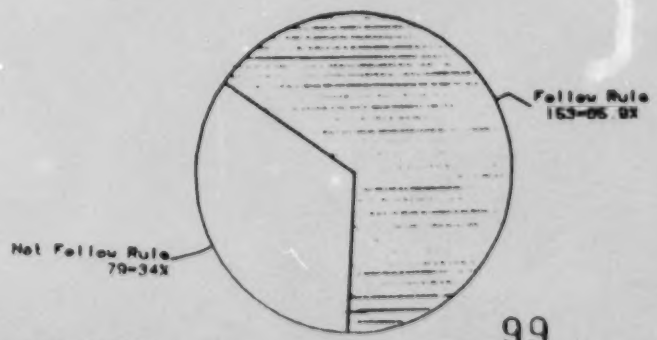
YEAR 4





YEAR 5





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APPENDIX A

INSTRUCTIONAL HIERARCHIES RESEARCH PROJECT

University of Washington — Norris Haring, Principal Investigator

BACKGROUND QUESTIONNAIRE

PART 1: EDUCATIONAL SETTING

1. For how many students in the following categories do you provide DIRECT service (instruction or therapy)?

How many:

- ☐ "learning disabled"
- ☐ mildly handicapped
- ☐ moderately handicapped
- ☐ severely handicapped
- ☐ profoundly handicapped
- ☐ other (describe):
- ☐ average total students per year
- ☐ average on any typical school day

2. Chronological ages: From: ☐ (youngest) years to ☐ (oldest) years.

3. Additional staff usually working with you:

Number of paid assistants:	☐	for a total of ☐	hours per week
Number of volunteers:	☐	for a total of ☐	hours per week
Number of others:	☐	for a total of ☐	hours per week

4. If you are a classroom teacher, do special service personnel (e.g. physical therapists, occupational therapists, communication disorders specialists) provide direct service (instruction or therapy) to one or more of your students?

☐ no ☐ yes ⇨ for an average total of ☐ hours per week

5. Do you serve as a supervisor for university/college/high school student teachers or practicum students?

☐ No ☐ Yes ⇨ Average number per quarter ☐ for ☐ total hours per week

PART 2: BACKGROUND

1. Number of years teaching school: ☐
2. Number of years teaching the handicapped: ☐
3. Have you ever had formal training in "Precision Teaching"? ☐ yes ☐ no

PART 3: INSTRUCTIONAL PROGRAMS

Instructional programs are those programs in which your objective is to increase behavior, either by teaching new behavior and skills, or by improving performance in skills and behaviors which the student has previously acquired. Not included are programs designed to decrease or eliminate behavior.

1. Different settings for individualized instruction are described below. Please estimate the percentage of your total instructional time conducted in each setting.

	Percentage
Individual responses in a 1:1 setting (teacher working alone with a student)	☐ %
Individual responses at natural opportunities (may be 1:1, small or large group, but student has opportunity to respond individually)	☐ %
Individual responses in group settings (may be small or large groups, but each student has a turn.)	☐ %
Unison responses in a group setting (may be small or large groups, but usually students respond together)	☐ %
Other: (please describe)	☐ %

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PART 4: EVALUATION

This section concerns the way you evaluate your students' progress in meeting his/her educational objectives (including, but not limited to, the IEP).

1. On what percentage of your instructional programs do you, your assistant or your student teacher usually collect at least some data on student performance?

- ☐ 95-100% of the programs
- ☐ 85-94%
- ☐ 75-84%
- ☐ 50-74%
- ☐ 25-49%
- ☐ 10-24%
- ☐ less than 10%

2. When you do collect some data on an instructional program, about how often is it collected?

Check one

- ☐ every time the instructional program is run
- ☐ about every time the program is run
- ☐ about half the time the program is run
- ☐ occasionally
- ☐ for initial assessment, diagnostic purposes and/or post-test only
- ☐ other (please describe):

3. When you do collect data on instructional performanc, do you usually collect data:

Check one

- ☐ on every trial
- ☐ on the first trial only
- ☐ on the last trial only
- ☐ other (please describe):
- ☐ on a random number of trials
- ☐ on special "probe" trials only
- ☐ all trials during a set amount of time

2. Approximately how often is EACH instructional program typically run?

Check one

- ☐ whenever a "natural occasion" for the target behavior occurs
- ☐ two or more preset sessions per day
- ☐ one preset session per day
- ☐ four preset sessions per week
- ☐ three preset sessions per week
- ☐ two preset sessions per week
- ☐ one preset session per week
- ☐ other (please describe):

3. Approximately how many opportunities or "chances" to perform or respond with the target behavior does the student usually have in any one instructional period?

Check one

- ☐ 1-5 trials ☐ 5-9 trials ☐ 10-15 trials ☐ 16-20 trials
- ☐ more than 20 trials
- ☐ as many as possible within a given period of time, but usually at least ☐ trials.
- ☐ depends on what happens in the "natural" occasion, but usually about ☐ trials
- ☐ depends on the student's performance, but usually about ☐ trials
- ☐ other (please describe):

4. Approximately how many hours per week do you spend planning or changing your instructional programs? ☐ hours per week

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4. Below is a list of different data types. Please put a one (1) by the type that you most frequently collect, a two (2) by the type you collect second most frequently, and so on. Leave the box blank if you never collect that type of data.

- ☐ count of behavior responses (how many times the behavior happens, but not %)
- ☐ count of trials (usually for "trials to criterion")
- ☐ levels of assistance (for example, counting the number of prompts required before the student responds)
- ☐ accuracy data (%)
- ☐ rate or frequency data (behavior counts per unit of time)
- ☐ time data (latency or duration)
- ☐ other (please describe):

5. Do you usually graph your data? ☐ yes ☐ no

6. Do you have specific student performance criteria or rules for deciding:

	yes for each program	yes, for some programs	no
when to move the student to the next program step?	☐	☐	☐
when the student has met aim?	☐	☐	☐
when the student should be moved to an easier step or to a prerequisite skill?	☐	☐	☐
when to change the instructional procedures, but keep the task the same?	☐	☐	☐
how to modify instructional procedures?	☐	☐	☐

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INSTRUCTIONAL HIERARCHIES RESEARCH PROJECT

University of Washington

Norris Haring, Principal Investigator

PRESENTATION RESPONSE QUESTIONNAIRE

PART 1: CLARITY OF INFORMATION PRESENTED

These questions concern the session(s) that you attended covering the experimental procedures. Circle one for each statement.

	Very Clear				Confusing
1. The information presented on the general purpose of the procedures was:	5	4	3	2	1
2. The information on collecting and charting data was:	5	4	3	2	1
3. The information on drawing lines-of-progress was:	5	4	3	2	1
4. The information on using decision rules was:	5	4	3	2	1
5. The information on establishing instructional formats was:	5	4	3	2	1
6. The information on the different types of instructional procedures was:	5	4	3	2	1
7. The information on implementing instructional strategies was:	5	4	3	2	1
8. Information on using the handbook was:	5	4	3	2	1
9. Overall, the information presented was:	5	4	3	2	1

10. General Comments:

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PART 2: ATTITUDE TOWARD THE PROCEDURES

1. What is your general attitude towards the experimental procedures following the presentation?

Very Favorable				Very Unfavorable
5	4	3	2	1

2. How useful do you think the procedures might generally be to teachers?

Very Useful				Not at all Useful
5	4	3	2	1

3. How applicable do you think each of the following would be to YOUR situation?

	Very Applicable				Not at all Applicable
a. Overall, the experimental procedures would be:	5	4	3	2	1
b. Designing initial instructional formats according to the information presented:	5	4	3	2	1
c. Conducting instructional programs with individual student responses on a regular basis:	5	4	3	2	1
d. Collecting performance data during an instructional program:	5	4	3	2	1
e. Charting performance data as described on a regular basis:	5	4	3	2	1
f. Using decision rules based on lines-of-progress:	5	4	3	2	1
g. Changing instructional methods as described:	5	4	3	2	1

4. Would you like additional information on any part of the procedures?

☐ no ☐ yes ⇨ Please check those that apply, and a member of the research staff will contact you shortly.

- ☐ using the handbook
- ☐ designing initial instructional formats
- ☐ selecting a data type
- ☐ implementing instructional procedures
- ☐ collecting performance data
- ☐ charting performance data
- ☐ drawing performance patterns
- ☐ using decision rules
- ☐ applying the general changes to specific programs
- ☐ other: (describe briefly)

Thank you!

INSTRUCTIONAL HIERARCHIES RESEARCH PROJECT

University of Washington

Norris Haring, Principal Investigator

HANDBOOK QUESTIONNAIRE

Approximately how much time have you spent reviewing the information in the Handbook?

_____ minutes _____ hours _____ other

These questions concern the clarity of information on the experimental procedures as presented in the Handbook. Please circle one for each statement.

	Very Clear				Confusing
1. The information on How To Make An Instructional Decision (p.5-7) is:	5	4	3	2	1
2. The Rules for Rate and the Quick Reference Guide for Rules for Rate are:	5	4	3	2	1
3. The Rules for Percent Correct and the Quick Reference Guide for Rules for Percent Correct are:	5	4	3	2	1
4. The Quick Reference Guides for Change Strategies (p.10-14) are:	5	4	3	2	1
5. The information on drawing lines-of-progress (p.15-24), and determining percent correct (p.25), performance variability (p.26-77) and sharp deceleration in corrects (p.28) is:	5	4	3	2	1
6. The information on General Considerations for Instructional Formats (p.29-35) is:	5	4	3	2	1
7. The information on Acquisition (p.36-63) is:	5	4	3	2	1
8. The information on Fluency-Building (p.64-95) is:	5	4	3	2	1
9. The information on Compliance (p.97-115) is:	5	4	3	2	1

We would like your comments and suggestions regarding the Handbook. Please use the back of this sheet.

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INSTRUCTIONAL HIERARCHIES RESEARCH PROJECT

University of Washington

Norris Haring, Principal Investigator

TRIAL PERIOD QUESTIONNAIRE

Today's date _____

A "trial" of the procedures might involve any range of activities, from applying the procedures with one student for one program for a few weeks, to all students and all programs for the rest of the school year. You decide on your level of involvement

1. Do you plan on using the procedures for a trial period?
   - ☐ yes ⇨ Go on to the questions below
   - ☐ no ⇨ Go on to page 2

---

2. Assistance is available for those participants who wish to try the procedures. Assistance is available if you need help in applying the procedures in your situation. Are you interested in receiving any follow-up assistance?
   - ☐ no
   - ☐ yes ⇨ A member of the research staff will contact you shortly.
3. At this time, what type of trial period do you plan? You can, of course, alter your plans at any time. Choose a, b or c.
   - a. ☐ with ⇨ ☐ student(s) and ☐ program(s) for ☐ week(s)
     Beginning on _____ (day) _____ (month) _____ (year)
   - b. ☐ undecided ⇨ A member of the research staff will contact you shortly.
   - c. ☐ other ⇨ A member of the research staff will contact you shortly.
4. Are other teachers in your school using these procedures?
   ☐ yes ☐ no ☐ don't know
5. Do you feel that the administration would provide support for the use of these procedures
   ☐ yes ☐ can't tell ☐ no ⇨ Why not?

Thank you for your continued support and assistance.

Fill out this page only if you do NOT plan to use the procedures.

2. Are other teachers in your school using these procedures?
   ☐ yes ☐ no ☐ don't know
3. Do you feel that the administration in your school or district would provide support for the use of these procedures?
   ☐ yes ☐ can't tell ☐ no ⇨ Why not?

4. Since you do NOT plan on using the procedures, we would be interested in your reasons. Please check all of the boxes below which apply, if any, AND/OR provide a written reason in the space provided.

   - ☐ I feel that the procedures will take too much time, which I just don't have
   - ☐ I feel that the procedures are not applicable to my students.
   - ☐ I feel that the procedures are not compatible with my curriculum.
   - ☐ I feel that the procedures are not compatible with my current instructional practices.
   - ☐ I do not feel the need to use the procedures.
   - ☐ I do not think that the procedures will improve the performance of my students.
   - ☐ I do not understand how to apply the procedures in my situation.

In the space below, please describe other reasons you may have for not using the procedures.

Thank you for your participation in this project.

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INSTRUCTIONAL HIERARCHIES RESEARCH PROJECT

University of Washington — Norris Haring, Principal Investigator

PROCEDURES QUESTIONNAIRE

PART I: EDUCATIONAL SETTING

1. For how many students in the following categories do you provide DIRECT service (instruction or therapy)?

How many:

- ☐ "learning disabled"
- ☐ mildly handicapped
- ☐ moderately handicapped
- ☐ severely handicapped
- ☐ profoundly handicapped
- ☐ other

- ◯ average total students per year
- ◯ average on any typical school day

2. Chronological ages: From: ☐ (youngest) years to ☐ (oldest) years.

3. Additional staff usually working with you:

Number of paid assistants: ☐ for a total of ☐ hours per week

Number of volunteers: ☐ for a total of ☐ hours per week

Number of others: ☐ for a total of ☐ hours per week

4. If you are a classroom teacher, do special service personnel (e.g., physical therapists, occupational therapists, communication disorders specialists) provide direct service (instruction or therapy) to one or more of your students?

☐ no ☐ YES ⇨ for an average total of ☐ hours per week

5. Do you serve as a supervisor for university/college/high school student teachers or practicum students?

☐ No ☐ YES ⇨ Average number per quarter ☐ for ☐ total hours per week

PART II: USE OF THE HANDBOOK

The following questions concern the usefulness of the Handbook during the Trial Period. Please circle one for each statement.

The information presented on:

	Very Useful				Not Useful
1. How to Make an Instructional Decision is:	5	4	3	2	1
2. Quick Reference Guides for change Strategies (p.10-14) are:	5	4	3	2	1
3. Drawing Lines of Progress (p.15-24) is:	5	4	3	2	1
4. Determining Percent Correct (p.25) is:	5	4	3	2	1
5. Determining Performance Variability (p.26-27) is:	5	4	3	2	1
6. Sharp Deceleration in Corrects (p.28) is:	5	4	3	2	1
7. General Considerations for Instructional Formats (p.29-35) is:	5	4	3	2	1
8. Acquisition (p.36-63) is:	5	4	3	2	1
9. Fluency-Building (p.64-95) is:	5	4	3	2	1
10. Compliance (p.97-115) is:	5	4	3	2	1

We would appreciate any comments or suggestions you may have regarding the use of the Handbook during the Trial Period:

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PART III: ATTITUDE TOWARDS THE PROCEDURES

Now that you have had a chance to try the procedures in your classroom, what is your general attitude toward:

	Very Favorable				Unfavorable	No Opinion
1. Using the procedures when instructional programs are established?	5	4	3	2	1	0
2. Collecting direct performance data?	5	4	3	2	1	0
3. Charting performance data?	5	4	3	2	1	0
4. Drawing Minimum 'Celeration (Aim) Lines?	5	4	3	2	1	0
5. Drawing Lines of Progress in order to apply rules?	5	4	3	2	1	0
6. Using the experimental decision rules?	5	4	3	2	1	0
7. Using the change strategies for instructional programs?	5	4	3	2	1	0
8. Overall?	5	4	3	2	1	0

PART IV: USING THE PROCEDURES

1. How many weeks have you used (did you use) the experimental procedures?

   ☐ weeks

2. How many of your students were involved? ☐ students

3. What was the total number of programs involved? ☐ programs

4. What rules did you use?

   a. ☐ Rules for Rate Data (on yellow paper).

   How often did you make decisions? Generally every ☐ data day(s).

   Have you come across data patterns which are not covered by the rules? ☐ Y ☐ N

   b. ☐ Rules for Percent Correct Data (on yellow paper)

   How often did you make decisions? Generally every ☐ data days.

   Have you come across data patterns which are not covered by the rules? ☐ Y ☐ N

   c. ☐ Experimental Rules for Use with Minimum 'Celeration.

5. Approximately how much time have you spent making instructional decisions and changing instructional programs?

   ☐ hours per week

   How does this compare with the amount of time you spent before using the procedures?

   ☐ more time ☐ less time ☐ the same amount of time

6. Indicate the total number of programs on which you collected the following types of data:

   ☐ regular rate
   ☐ adjusted rate
   ☐ percent correct
   ☐ duration (trial method)
   ☐ duration (session method)
   ☐ latency

7. Overall, in your opinion, what impact have the decision rules had on pupil progress as compared with their progress prior to the trial period?

   ☐ accelerated pupil progress
   ☐ decelerated pupil progress
   ☐ no difference

PART V: THE FUTURE

We would like to use your data in order to collect additional information concerning the effectiveness of the procedures.

1. Would you be willing to send us copies of your pupil performance data and/or decision record sheets, if we pay for the copying?

   ☐ yes (a member of the research team will contact you)
   ☐ no

2. Do you plan to continue using the experimental procedures as a regular part of your classroom activities?

   ☐ yes ☐ no

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3. Would you like to extend the trial period?

- ☐ yes (a member of the research team will contact you)
- ☐ no

If you do not plan on extending the trial period, and/or you do not plan on using the procedures after participation in this study, we would appreciate knowing your reasons:

Thank you for taking the time to complete this questionnaire and for your participation in this study.

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APPENDIX B

FIELD INITIATED RESEARCH STUDIES

AN INVESTIGATION OF STAGES OF LEARNING AND FACILITATING INSTRUCTIONAL EVENTS FOR THE SEVERELY/PROFOUNDLY HANDICAPPED

Norris G. Haring, Principal Investigator

Kathleen A. Liberty, Project Coordinator

Owen R. White, Research Associate

DATA-BASED DECISION RULES FOR INSTRUCTIONAL PROGRAMS

JUNE 1980

The material contained herein and presented at the conference is based on research which is continuing. Results subject to reinterpretation at the drop of a data point. If you would like to be kept up to date on changes, please write c/o Experimental Education Unit, WJ-10, Child Development and Mental Retardation Center, University of Washington, Seattle, Washington 98195.

The material contained herein was developed pursuant to a grant from the Bureau of Education for the Handicapped, U.S. Office of Education, Department of Health, Education and Welfare. Project No. 443CH6039A, Grant. No. G007500593. Contractors undertaking such project under government sponsorship are encouraged to express freely their professional judgement in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official positions of the Bureau of Education for the Handicapped.

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PREREQUISITES FOR USE OF EXPERIMENTAL DECISION RULES

1. Design programs to teach new behaviors or to improve performance. The rules are not designed to be used with programs aimed at decelerating or eliminating behavior.

2. Plan for a consistent instructional format which you will use each day. The plan should include: the antecedent events (cues, stimuli, materials, instruction) you will use to get the behavior started, a precise definition of the behavior you want to see, and the subsequent events (like praise and prompting) you will use to provide feeback and consequate performance).

3. Provide the opportunity for the student to respond individually and independently at least ten times during the instructional session. You may choose to provide the student with a very short period of time in which to respond, and then assist the student to respond if he/she doesn't during the period you allow. Or, you may design your program so that the student has the opportunity to perform just a small part of the behavior independently. If the student can not perform any part of the response independently, you should consider moving to a different related skill or to an easier skill level.

4. Conduct the instructional session at least once per day for several days without changing the format you set up. The greater the number of opportunities, the faster the learning. The decision rules will tell you when you should change your instructional plan. It is important not to change on every trial or every day (unless the student meets criteria) to give the plan a chance to work. Changing tactics every trial and/or every day may confuse the student. (You may want to change every trial if you are programming for generalization, but then the changing itself would be consistent and part of your plan.)

5. Determine the performance aim--what type of performance is desireable? How accurately should the student perform? How fluently? Usually accuracy criterion by themselves (e.g. 80% correct) are not sufficient to ensure mastery and maintenance. Some time component will show fluency, either use rate, duration or latency in determining performance aims. Use the performance of nonhandicapped peers as guidelines in determining aims; using lower aims will ensure "retarded" performance.

6. Select an appropriate target date, by which you want the student to achieve the performance aim. At first, it may be difficult to select a date, but with practice, you will be able to select dates that are both reasonable, achievable and desireable.

7. Collect and chart performance data. Try to collect data each time you conduct the program. Chart the data so that you will be able to visually determine the progress of the student to the goal. The decision rules are designed to be used with ratio interval chart paper.

DATA TYPES

RATE DATA

When to collect it

Rate data should be collected when rate or frequency of performance is the most important aspect of fluency, and when the situation is structured so that the student is "free" to perform during the entire observation period. It should not be used when the instructional or intervention plan specifies antecedents or consequences which interrupt performance. For example, rate would be collected in a sorting program when the behaver was given all of the materials necessary to sort at the beginning of the observation period. If, however, the manager were required for some reason to give the student the materials one at a time, or to consequate each "sort" with prompts and/or food, the antecedents and consequences interrupt the student's performance, and thus adjusted rate data should be used instead.

How to collect it

a. Determine the length of time you will provide the behaver in which to respond. Usually the same length of time is provided each session (e.g. a ten minute period). Or, you may decide to time how long it takes the behaver to complete a certain number of responses (length of time for ten trials, for example).

b. Arrange the setting so that the behaver is free to respond during the entire period. Usually this will entail providing enough "work" so that the behaver will not finish before the time is up.

c. Give the signal to start performing, and start the stopwatch. Do not wait for the student to start, but start the watch at once.

d. Count the number of responses the student makes, both correctly and incorrectly, either during the timing itself, or by checking the work after the timing is completed.

e. Stop the stopwatch at the end of the predetermined observation period, and give the signal to stop performing to the behaver. Record the length of time and the frequency counts.

How to chart it

1. If the length of time you recorded involves "seconds", either when it is less than one minute (e.g. 30 seconds), or a whole minute plus a fraction of a minute (e.g. 5 minutes and 40 seconds), use the attached table to convert the seconds to a decimal fraction (e.g. 30 seconds = .5; 5 minutes 40 seconds = 5.68). Use the decimal fraction in performing all of the calculations described.

2. Fill in the information on name of behaver, manager, movement cycle, date, and so on. Use a separate chart for each movement cycle if possible, to avoid confusion when using decision rules. (Do not use different colored pencils for each response, for example).

3. Record the length of observation time on the chart by:

$$\frac{1}{\text{length of time}}$$

If you observed for longer than one minute, the result of this division will be a

decimal fraction (1/5.68 = .18). If you observed for less than one minute, the result of this division will be a whole number (1/.5 = 2). Find the result on the left-hand vertical scale on the chart. Find the day line for the date of your data. Record the length of observation time as a horizontal bar across the day line. Recording the length of observation time is very important, since it serves as one of the bases for comparing changes in performance.

4. Record the rate of performance by: $\frac{\text{count the number of correct responses}}{\text{length of time}}$

For example, if you recorded 10 correct responses in 5.68 minutes, the rate of correct responses would be 10/5.68 = 1.7. If you recorded 7 correct responses in 30 seconds, the rate of correct responses would be 7/.5 = 14. Find the day line for the date of the data. Record the frequency of correct responses as a dot. The frequency will be above the bar denoting the observation time. The rate of incorrect responses is calculated in the same way, and recorded on the chart as an x.

If you recorded only 1 response, the dot or x will fall directly on the horizontal bar which denotes length of observation. If you recorded 0 responses, chart a ? directly below the horizontal bar. The ? is used since we do not know, and cannot calculate, the rate of responding.

ADJUSTED RATE DATA Trial Method

When to collect it

This type of data should be collected when performance of the behavior is interrupted by antecedents and consequences, and when rate is the critical time dimension. For example, during the beginning stages of a sorting program, each object sorted may be consequated with a squirt of juice in the pupil's mouth. In this case the delivery of the consequence interrupts the student's performance period, and adjusted rate data should be collected. Or, if each object to be sorted is given separately to the student, the student must wait for the object before sorting, the delivery of the antecedents interrupts performance in this case.

How to collect it

a. Arrange the materials for one trial (or two or three, depending on plan), provide antecedents and give signal to respond.

b. Start the stopwatch immediately following the signal to respond.

c. Stop the stopwatch when the pupil completes the response (either correctly or incorrectly) or when the allowable latency period has expired.

d. Record whether or not the trial was correct or error, consequate according to plan, and go on to the next trial. It is not necessary to record the time for each trial; time can be accumulated on the watch and recorded at the end of the session.

How to chart it

Chart it just as you would chart "regular rate" data.

LATENCY DATA

How to collect it

a. Latency data measures the time between the end of the stimulus or direction

to perform the behavior and the behavior itself. Teacher says "Hi" latency "Hi" says the student.

b. Start watch at end of stimulus, and stop watch at beginning of behavior.

c. For general usage: Do not reset watch at end of each trial; accumulate time on watch. Keep track of the number of trials. Record time at end of all trials.

How to chart it

Chart average latency per trial OR
average latency per correct response and average latency per error response. These are equivalent to the average frequency charted for rate data.

1. Relabel the vertical axis "Average Latency in Seconds", and fill in the identification information.

2. Determine performance ceiling.

In most latency programs there is an allowable latency limit established as part of the program. Usually this limit is 5 seconds per trial. If no response has been initiated 5 seconds after the direction, the contingency for no response (e.g. a mandate) is implemented. The latency limit must be charted as a ceiling, since the contingency will prevent responding when the limit expires.

a. Find the limit on the left hand scale of the chart. If the limit is less than 1 second, it will be below the 1 line.

b. Mark the limit as a dashed line across the chart.

3. Convert the total latency time into the appropriate decimal equivalents, utilizing the table attached (e.g. 12 seconds = .2).

4. Find the average latency per trial:

$$\frac{\text{total latency}}{\text{number of trials}}$$

Find the result of the calculations on the left-hand vertical scale of the chart. Find the appropriate day line. Chart the result with a dot if the program is designed to accelerate latency, and as an x if the program is designed to decelerate latency. If 0 latency is recorded, chart a ? above the ceiling.

DURATION DATA (Session method)

When to collect it

Collect duration (session) data when the length of time the behavior lasts is the most important aspect of fluency, and when the situation is structured so that the student is "free" to perform during the entire session. For example, length of time with head held in midline would be appropriate for the duration session method if the observer watched the student and did not attempt to hold the student's head in place, and if the student were able to move his head up once it had fallen. If the student were unable to move his head up, then the trial method would be most appropriate. Duration data, session: this method of collecting duration data is usually appropriate when the aim of the program is to decelerate the duration of various self-help skills. The aim of a shoe-tying program may be, for example, to decelerate time spent tying a shoe from three minutes to five seconds.

How to collect it

Start watch when the behaver begins performing the desired behavior and stop watch when the behavior stops. Accumulate time on the watch. ALSO, record total session length. Record time of day when you begin collecting data and time of day

when you stop collecting data. In the example, session time would include both time on task and time off task.

How to chart it

1. Relabel the vertical axis of the chart: "Minutes Duration Per Session". Fill in the identification information.
2. Find the "session time". The length of the session is a "performance ceiling", since the student cannot record more time than the length of the session. Find the length of the session time, in minutes, in the left-hand scale of the chart. Chart the ceiling as a bar across the day line. If the session length is the same every day, chart a dashed line across the chart.
3. Find the "duration". This is the length of time in minutes and decimal equivalents of minutes that the behavior occurred during the session. Find the duration in the left hand scale of the chart. Plot it at that point on the appropriate day, using a dot if the aim is to accelerate duration and an x if the aim is to declerate duration.

DURATION DATA Trial Method

When to collect it

This type of data would be used when performance of the behavior is interrupted by antecedents and consequences. For example, in a "Hold head in midline" program designed to increase duration, an atonic neck reflex which pulled the head out of midline would both end the trial and result in the need for the manager to normalize the pupil's muscle tone prior to the next trial. In another example designed to decrease duration, the pupil's completion of zipping his jacket ended the "coat on" trial. The jacket had to be removed before the next trial could begin. In such cases, use the trial method.

How to collect it

Start watch at beginning of trial/behavior and stop watch at end of trial/behavior. Accumulate time on watch. If separate duration for correct and error trials is desired, each trial must be recorded separately.

How to chart it

1. Relabel the chart "Average Duration in Minutes", and fill in the identification information.
2. Convert any seconds to decimal equivalents, using the attached table.
3. Find the average duration per trial by:

$$\frac{\text{total duration}}{\text{number of trials}}$$

Find the result on the left-hand scale of the chart, and find the appropriate day line. Plot the data as a dot if the aim is to accelerate duration and as an x if the aim is to decelerate duration.

4. If you record a total of 0 seconds duration, you will need to determine the smallest amount of time your stopwatch can accurately record. Although the accuracy may vary, you may assume that the smallest amount of time is 1/10 of a second. To find where 1/10 of a second is, convert it to its decimal equivalent (1/10 divided by .0166/10 = .0016), find that fraction on the left-hand scale of the chart, and chart

it as a horizontal bar across the day line. Record "0 duration" as a ? just below that line.

5. If you desire separate plots for "correct" and "error" trials, follow the directions for step 3 separately for "number of correct trials" and for "number of error trials".

USING DATA DECISION RULES TO ACCELERATE PERFORMANCE RATE

1. Determine the behavior to be changed, the performance aim, and the instructional format. Select a target date. Document the procedures.

2. On your chart, find the vertical day line which is the calendar date you selected for the target date. Find the horizontal line equivalent to your performance aim. Draw a ⋀ at the intersection of the aim and the date.

3. Implement the program, collect and chart three days of data.

4. To set the minimum 'celeration line, follow these steps:

   a. Find the second data day.
   b. Find the second highest correct performance, if you are setting the aim for corrects. If you are setting the aim for errors, find the second highest error performance.
   c. From the intersection of the second data day and the second highest performance, draw a line to the ⋀ .

   This line describes the minimum 'celeration: the change aim.

5. Continue running the program and collecting and charting the data. Since the minimum 'celeration line describes the desired change not the actual change, each day that you chart you should decide. Keep the following in mind when you are charting:

   a. Is the pupil at aim ? If the pupil reaches the aim, you should move to the next curricular step or program as soon as possible. Delaying may set the stage for poor performance. The chart should tell you beforehand that the student is getting close to the aim. Return to step 1 for next program step.
   If the pupil is not at aim, go on to the following questions.

   b. Is the pupil progressing? A pupil may be above the minimum 'celeration line but not progressing. If you think the pupil may not be progressing, draw a line-of-progress for the most recent six days of data. If that line is flat or going in the opposite direction from the one you desire, make a change using the procedures described below. This step is very important, especially if the student's actual progress is not very "near" to the minimum 'celeration line.

   c. Has the pupil's performance fallen below the minimum 'celeration line (above for deceleration projects) for <u>three consecutive</u> data days? If the answer to this question is "yes", it is probably time to make a change in your program.

6. If you decide to make a change in the instructional format, you can use the decision rules to help decide what area of the format is most likely to need changes.

   a. Draw a line-of-progress for the six most recent data days. This may include the three below the line and the three before those three.

   b. Use the attached flow chart and list of format considerations for ideas on what to change.

7. Once you have selected new procedures, document them. Now set a "new" minimum 'celeration line. Follow these steps:

   a. Implement the new procedures and collect the performance data.

   b. On your chart draw a vertical line 1/2 day before the first day of the new procedures.

   c. Find the second highest day of the last three days of data (the last three in the "old" procedures).

   d. Make a mark on the vertical line which is "equal to" the performance of the second highest day of the last three days of data.

   e. Now draw a line from the mark to the . This will make the new line steeper.

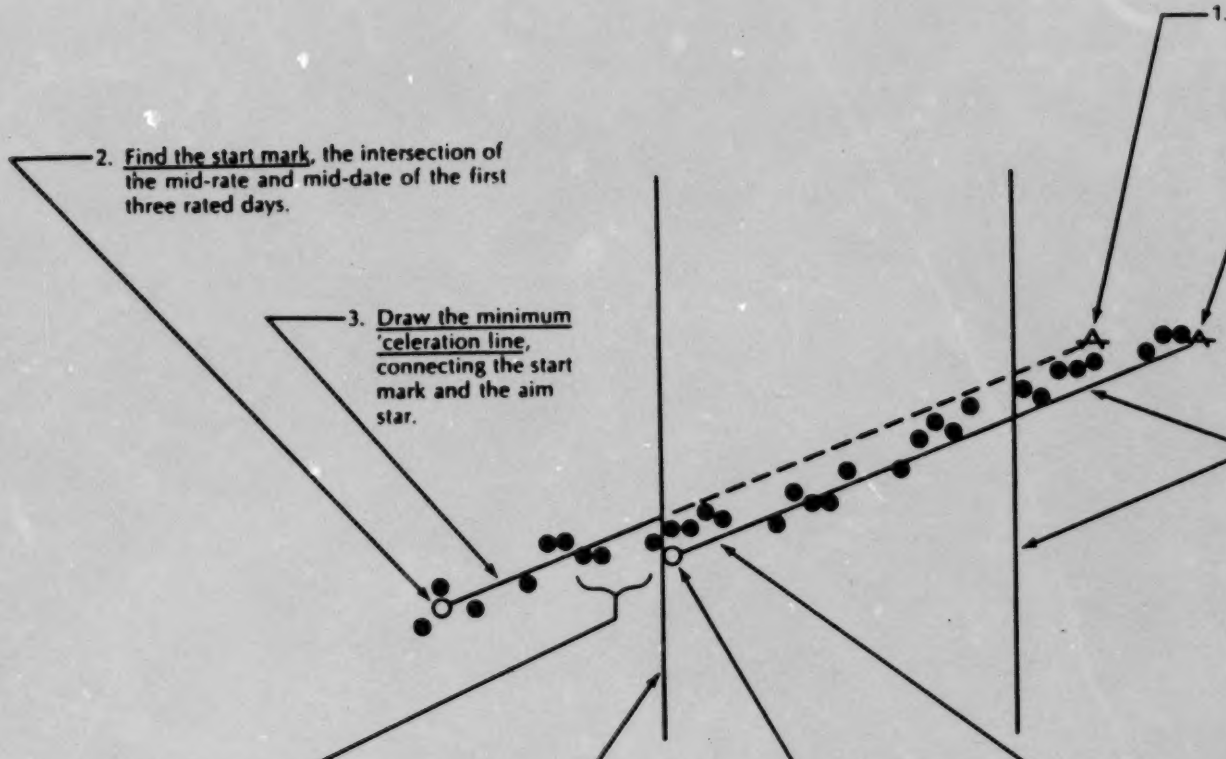
      If you do not want a steeper line, draw the new line parallel to the old line. This will change your target date. Draw a at the intersection of the new line, the performance aim and the new date.

      This procedure prevents the new procedures from having a terrible effect for more than three days. If the new procedures are not effective, the behaver will be below the new line for three consecutive days. If this happens, make a change of the same type as you made before. For example, if you made a consequence change, make another consequence change. Follow procedures 7a-7e again. If the behaver still ends up below, the rule is not working at all, and use your intuition---we really don't know how to advise you, since this hasn't happened to us. Please call us if it happens to you!

8. Continue conducting the program and collecting and charting performance data. Remember to ask yourself questions about the performance as your are charting. AND REMEMBER, THERE ARE NO MAGIC RULES...you may have more success by changing according to your intuitition, knowledge and experience.

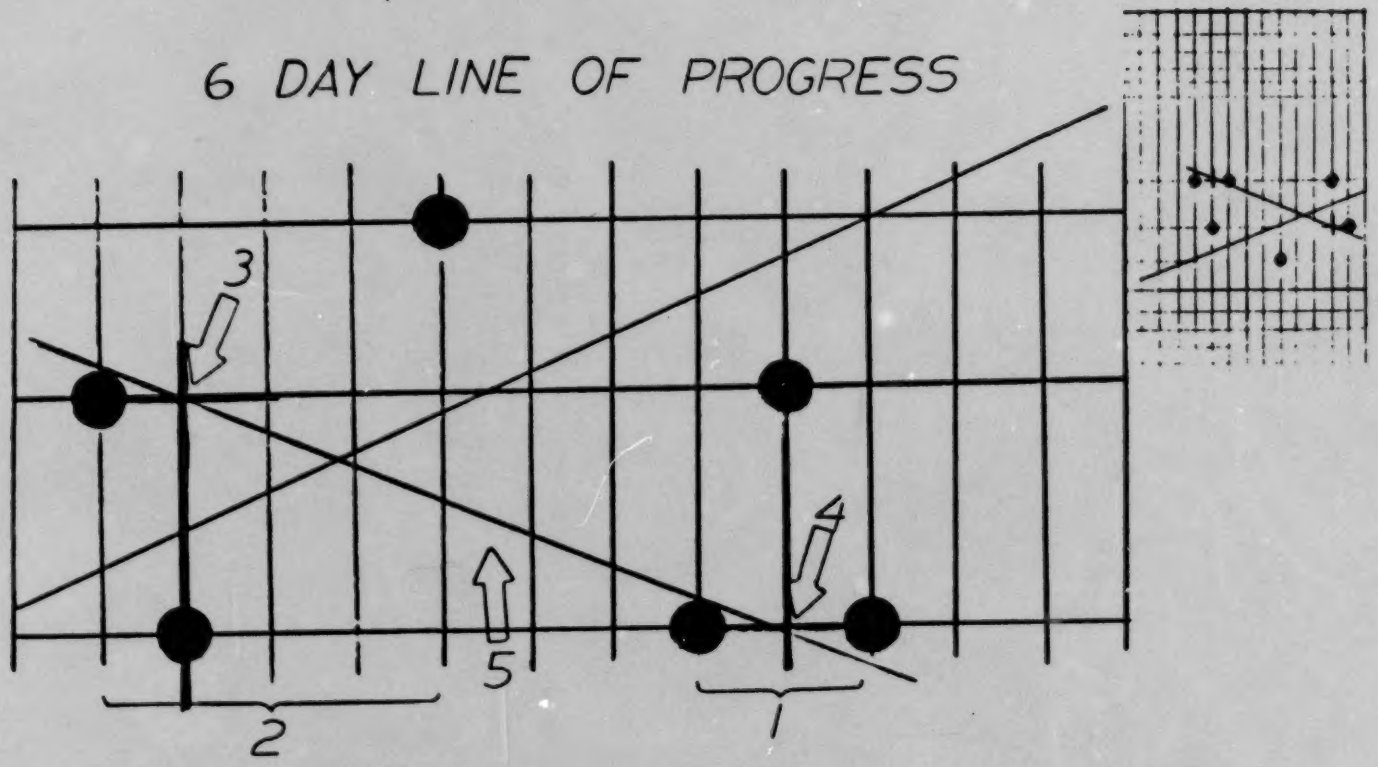
Minimum 'Celeration Line

from: White, O.R. & Haring, N.G. Exceptional Teaching, Charles E. Merrill, 1976



1. Set the aim star, the intersection of the aim rate and aim date.
2. Find the start mark, the intersection of the mid-rate and mid-date of the first three rated days.
3. Draw the minimum 'celeration line, connecting the start mark and the aim star.
4. Whenever three successive rates fall below the minimum 'celeration line, change the instructional plan.
5. Draw a phase-change line, 1/2 days before the first rated day under the new plan.
6. Locate a new start mark by placing a dot on the intersection of the first rated day under the new plan and the mid-rate of the last three assessments under the old plan.
7. Draw a new minimum 'celeration line, either between the old aim star and the new start mark or parallel to the old minimum 'celeration line (the second option is illustrated here).
8. Draw a new aim star, if necessary, at the point where the new minimum 'celeration line intersects the aim rate.
9. If a change in the program is made for any other reason than a failure to meet the minimum 'celeration criterion, draw a phase-change line as before but continue the old minimum 'celeration line without change.

6 DAY LINE OF PROGRESS



1 3 consecutive days below minimum celeration line

2 3 days preceding
mid-day of first 3 days
mid-level of first 3 days

3 intersection
mid-day of last 3 days
mid-level of last 3 days,
when 2 are the same,
that will be the middle

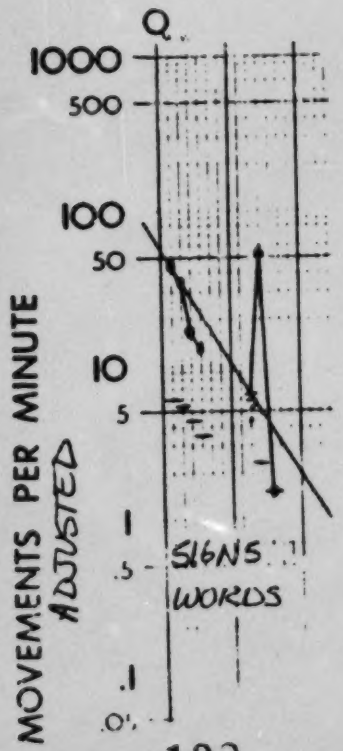
4 intersection

5 connect intersections

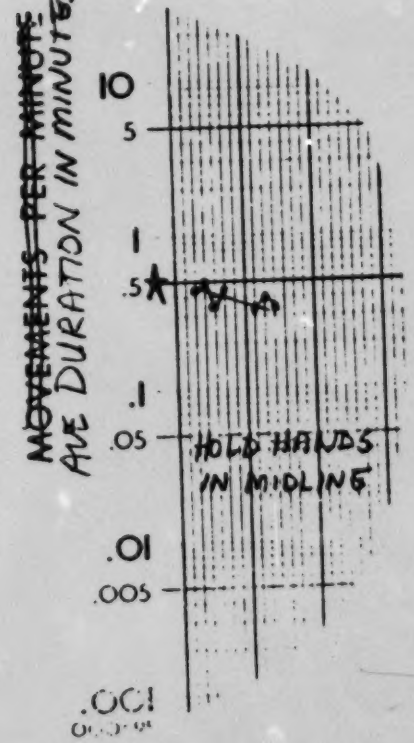
SHARP DECELERATION IN CORRECTS

A sharp deceleration in correct performance usually involves going from a fairly high level of performance to a low level. Examples are shown below.

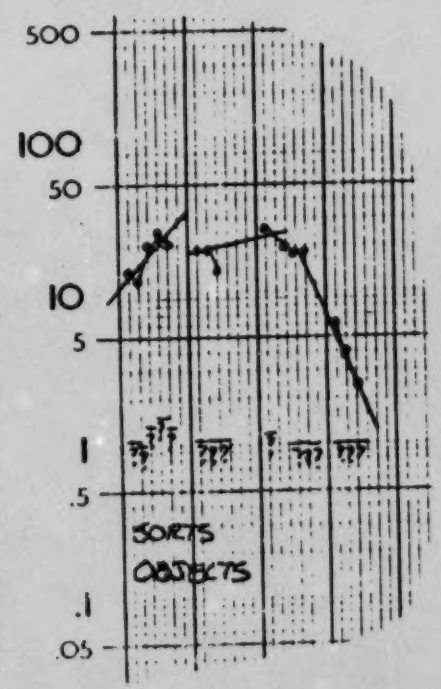
SHARP



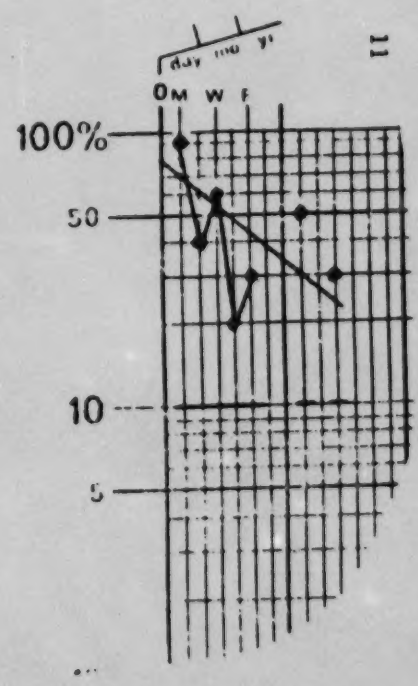
NOT SHARP



SHARP



SHARP



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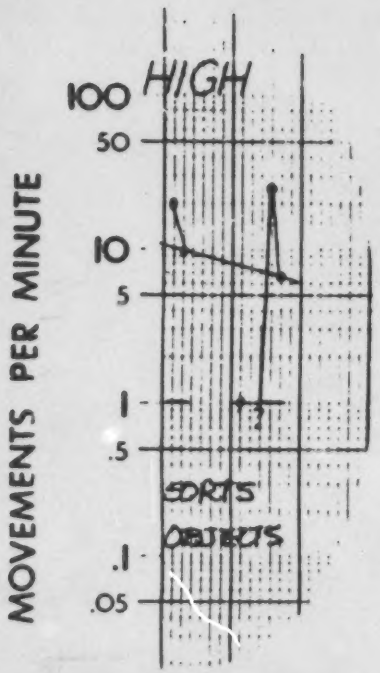
PERFORMANCE VARIABILITY

Performance variability is determined by comparing the data points with the line-of-progress. If most of the data points are further away from the line than the distance between 2 and 3 on your chart, variability is HIGH. Examples are shown below and on the next page.

PERFORMANCE VARIABILITY REFERS ONLY TO "CORRECT" PERFORMANCE



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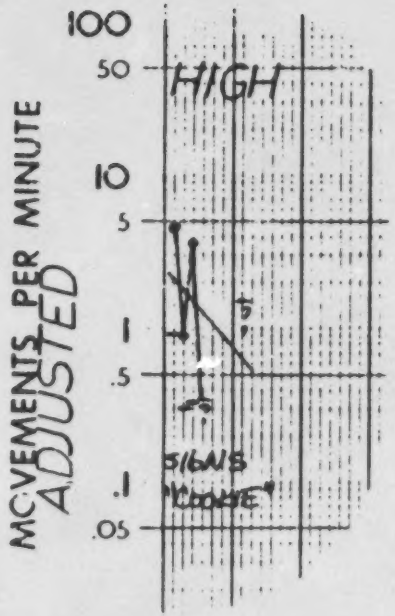

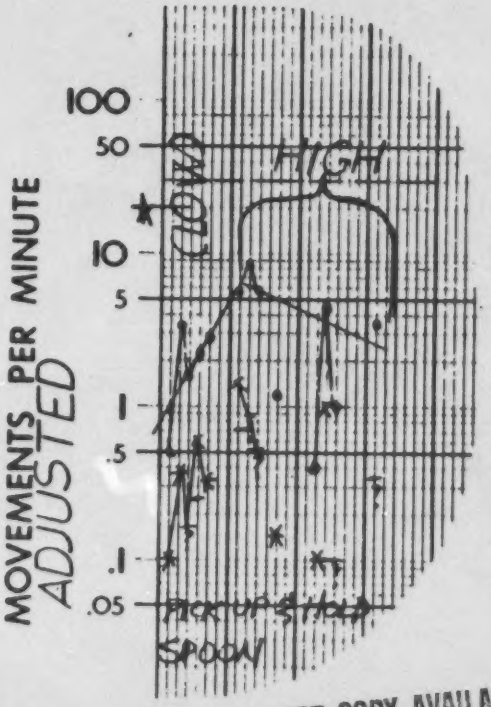

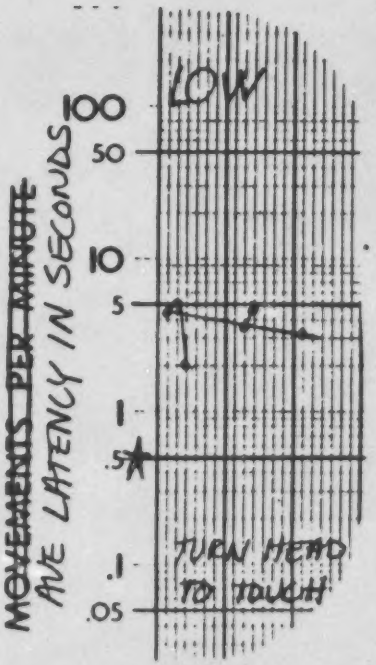

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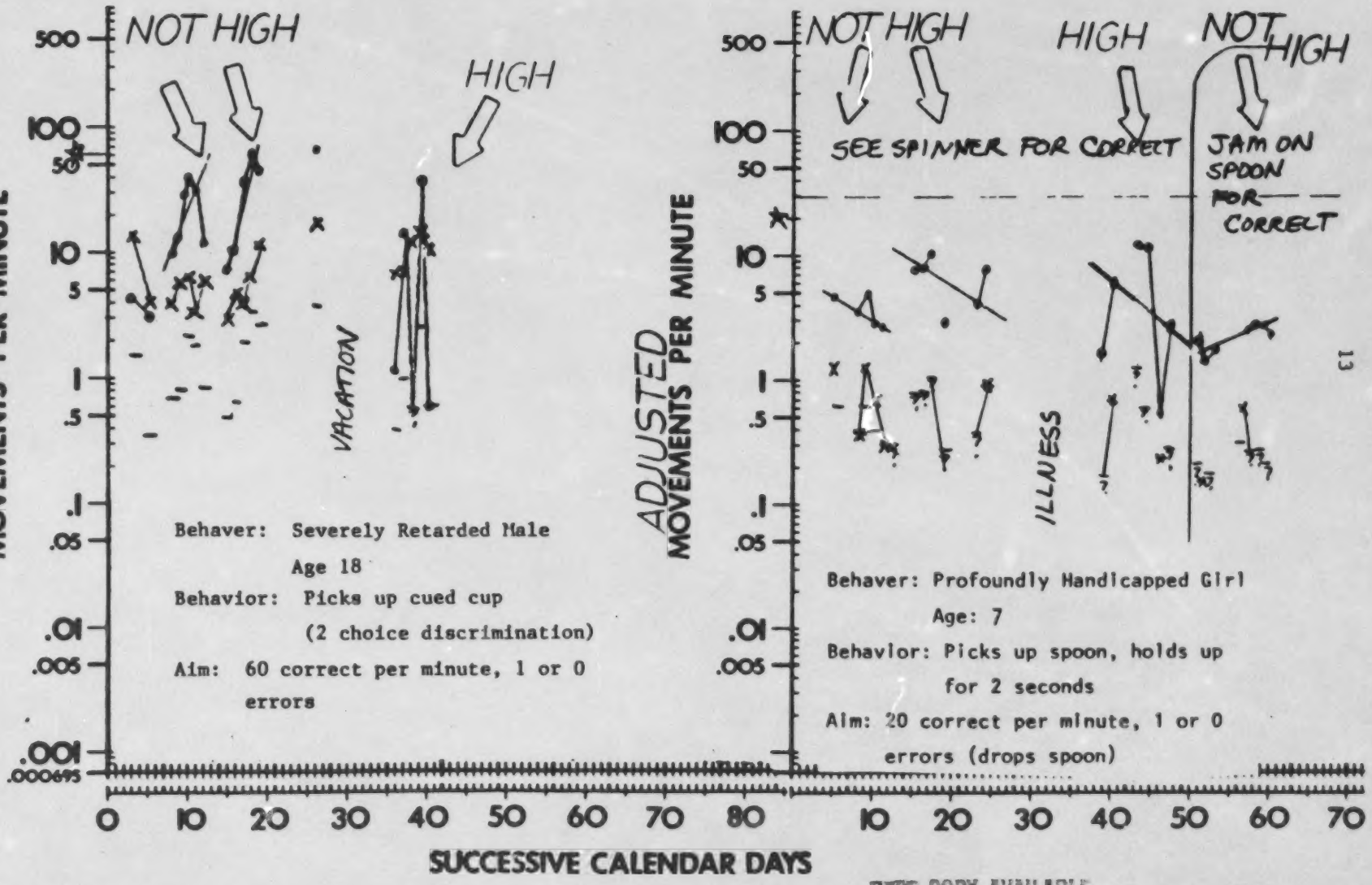
PERFORMANCE VARIABILITY



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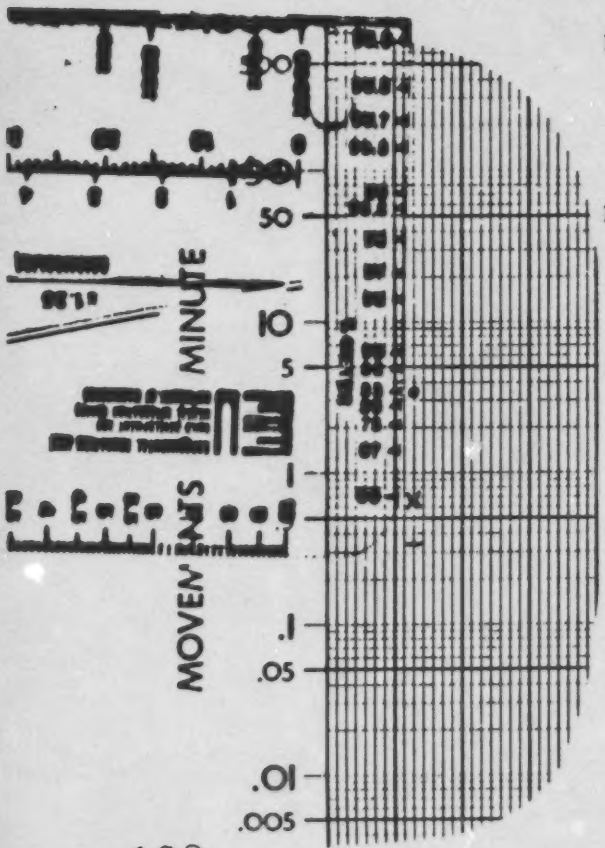
PERCENT CORRECT

The Percent Correct should be above 83% for the majority of data days in order to answer this question "Yes."

To determine Percent Correct:

Method A: For each day of data, add the total correct to the total errors for the total trials. Divide the total correct by the total trials.

Method B: Use the "% Meter" on top of your "EEU Rate Plotter". Put the "50" line on the errors and read the % Correct next to the "plot dot" for corrects. Of course, if errors are higher than corrects, corrects will be less than 50% and the plotter will not work. If corrects are at "zero" (below the floor), corrects are at 100% and the plotter is unnecessary.



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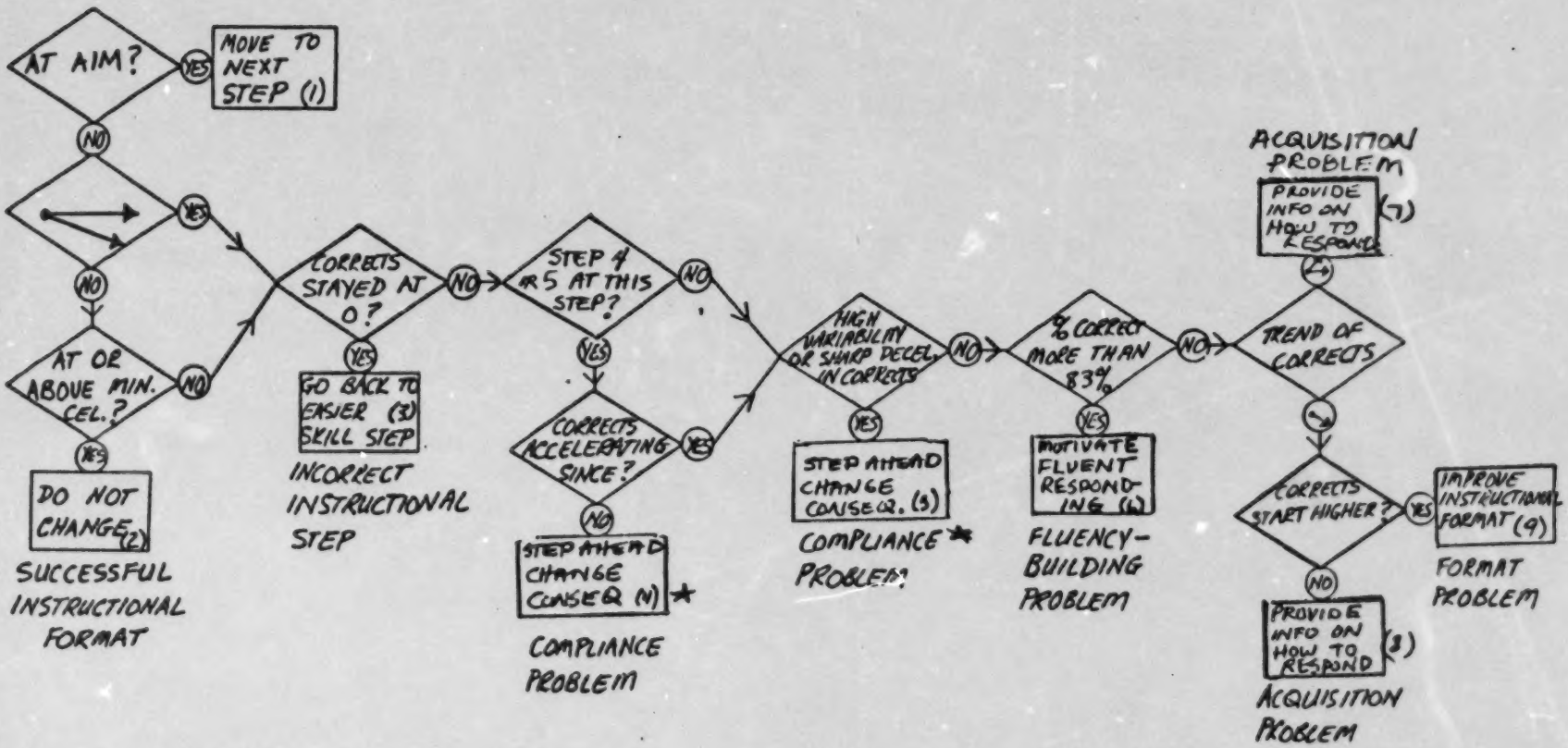
INSTRUCTIONAL HIERARCHIES RESEARCH PROJECT

University of Washington

Norris Haring, Principal Investigator



EXPERIMENTAL RULES FOR USE WITH MINIMUM CELERATION

ACCELERATE RATE OF RESPONDING

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DESIGNING AND CHANGING INSTRUCTIONAL FORMATS

General Considerations

1. Are you providing the opportunity for independent responding? Have you established an allowable latency period?
2. Do you have appropriate consequences? Do you have different consequences for correct and incorrect responses?
3. Are you using appropriate signals to get the behavior started?
4. Are your materials natural and age-appropriate?
5. Is the setting for instruction appropriate?

Format Considerations for Acquisition

1. Reinforce accurate performance.
2. Provide sufficient response opportunities.
3. Provide as little assistance as possible
4. Provide as little extra information as required
5. Consider the entire behavior
6. Consider generalization when you choose constant or varied stimulus events

Strategies for Acquisition Problems

Provide additional information as a
consequence for error responses
antecedent to the opportunity to respond
or conjugate with responding

1. Change verbal/signed/gestural direction or signal
2. Add gestural cues
3. Add verbal cues/stress key words
4. Add a permanent model
5. Add a manager demonstration
6. Add physical prompts
7. Add an assisted demonstration
8. Add position/color/emphasis cues to instructional materials

Format Considerations for Fluency-Building

1. Reinforce fluent performance.
2. Increase opportunities to perform the behavior (drill & practice)
3. Increase the freedom to perform the behavior
4. Increase the rate of teacher-presentation
5. Consider generalization

Strategies for Fluency-Building Problems

1. Provide directions for fluency before/during performance
2. Add/change consequences to motivate correct/fluent responses. Use a "reinforcer survey" to identify possible consequences; provide "variable" consequences, a different type each time; hide the prize until it is earned; use conjugate consequation.

3. Change the schedule for consequation of correct/fluent responses. Increase the ratio or interval of the schedule; use a variable schedule; delay conjugate consequeation.

4. Implement a changing aim strategy, increasing the amount of behavior required to receive consequation daily; tell or show the student how much "work" she/he must finish
5. Increase the number of response opportunities.
6. Increase practice/drill
7. Work with a more competent peer.
8. Add/change consequences for disfluent/incorrect responses

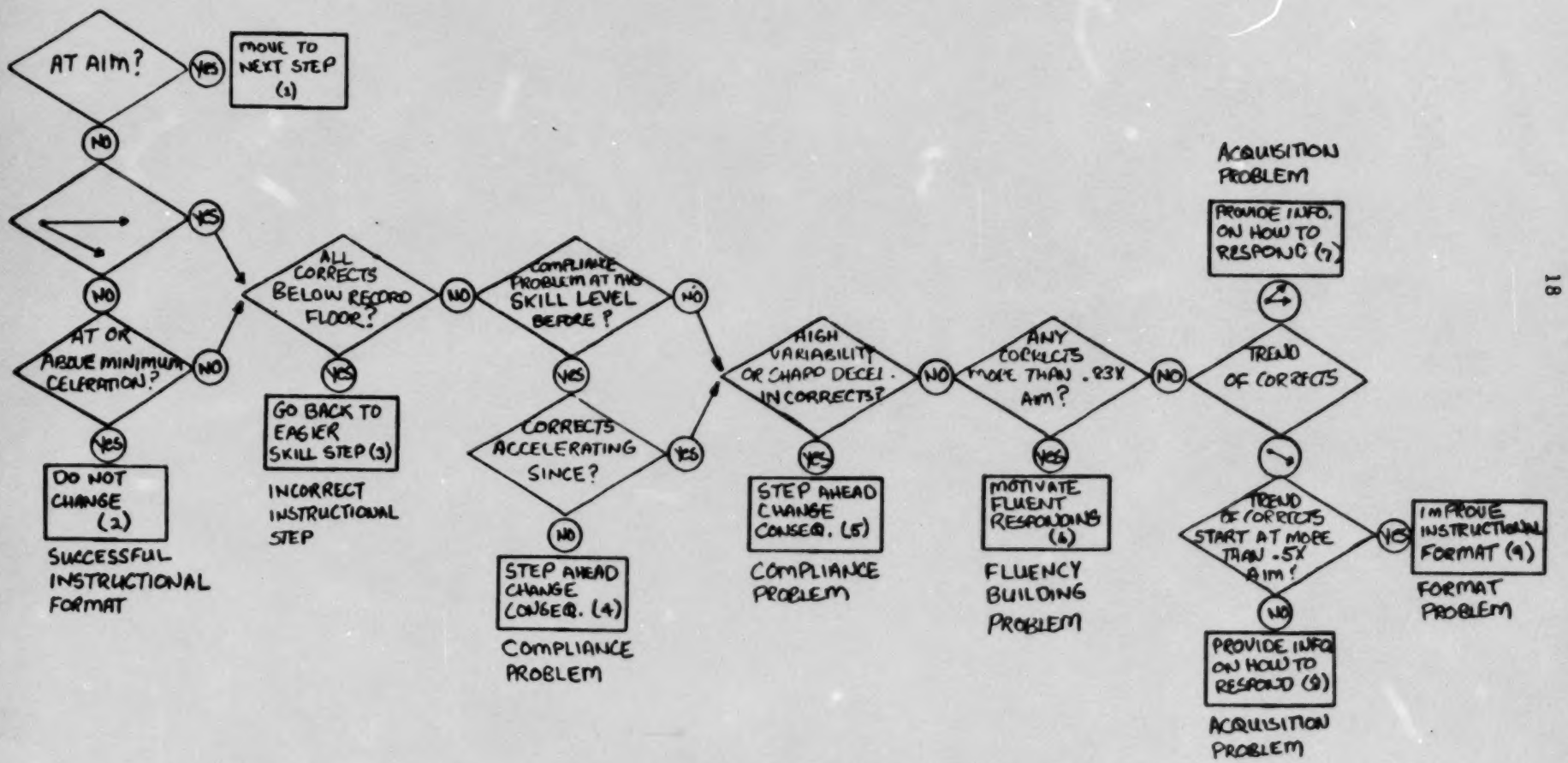
Strategies for Compliance Problems

1. Move to a more difficult skill level. Are you sure this skill level is the correct one? Are your criteria too high? Do you require a lot of days at criteria? Is the student bored?
2. Change or add a motivating consequence for correct/fluent performance.
3. Change the schedule for consequation of correct responses to avoid satiation.
4. Institute a response cost procedure (Gain for correct/fluent, lose for error/disfluent).
5. Eliminate competing consequences.
6. Add a time limit for no responses/change or add a motivating consequence for no responses and for errors (Caution: parental/guardian permission advised prior to implementation of aversive, negatively reinforcing or punishing consequences).
7. Institute "all day" procedures for compliance.
8. Avoid: moving to an easier skill level; repeating the instructions; coaxing or prompting the response; providing assistance; completing the response yourself; threatening the student; warning the student.

INSTRUCTIONAL HIERARCHIES RESEARCH PROJECT

University of Washington

Norris Haring, Principal Investigator



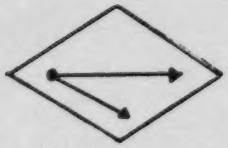
ACCELERATE DURATION OF RESPONDING

EXPERIMENTAL RULES FOR USE WITH MINIMUM CELERATION

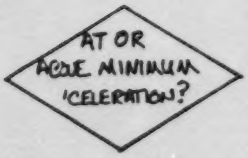
SUPPLEMENTAL RULE SHEET: ACCELERATE DURATION OF RESPONDING

The Supplemental Rule Sheet is an expanded text version of the accompanying flow sheet for "Accelerate Duration of Responding". Each diamond-shaped figure represents a decision point followed by a short explanation which should help you make an instructional decision. Since much of the information has been presented in the two inserts "Using Data Decision Rules" and "Data Types", a quick review of these sheets would be helpful.

If the student has met aim, you should move to the next curricular step or program as soon as possible. If the student has not met aim, go on to the next question.



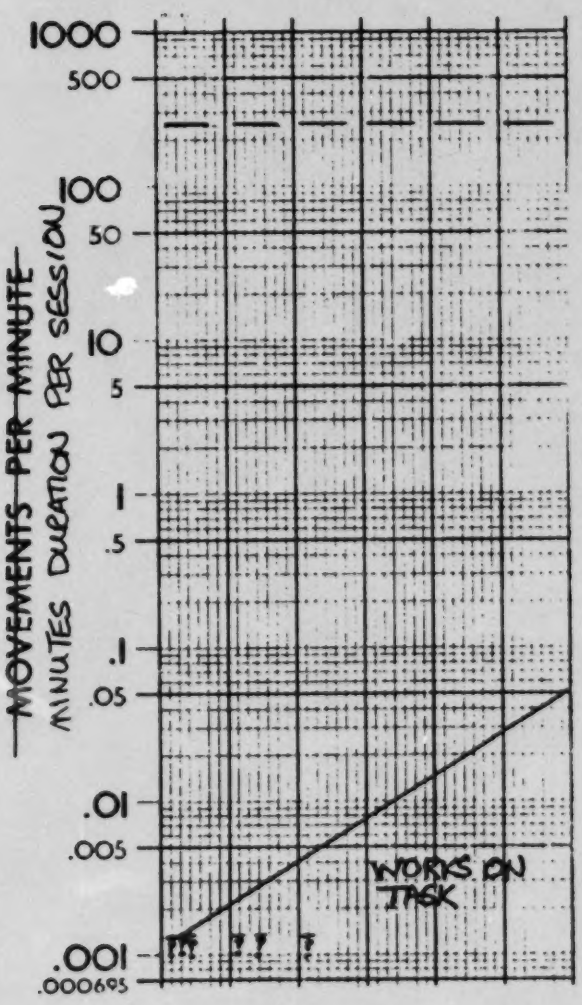
Is the student progressing? A student may be above the minimum 'celeration line but not progressing. If you think the student may not be progressing, draw a line of progress for the most recent six days of data. If the line of progress is flat or decelerating, make a change in the instructional program. Refer to the insert on "Using Data Decision Rules with Minimum 'Celeration" for instructions on drawing a new minimum celeration line.



Has the student's performance fallen below the minimum 'celeration line for <u>three consecutive days</u>? If so, then it is time to make a change in the instructional program.

In programs designed to accelerate the duration of student responding, the record floor represents the smallest amount of time that your stopwatch can accurately record. If all of the target performance is below the record floor, the skill is too difficult, and you should probably step back or slice back to an easier skill level. <u>Example</u>: In a program designed to increase the duration of working on task, a minimum 'celeration line was drawn from the results of a three day assessment to the program aim of four hours (by the end of the year). Following the initial assessment, 0 <u>sec</u> duration was recorded for three consecutive

days.To determine the record floor, convert the smallest amount of time that your stopwatch can record to a decimal equivalent in minutes (.1/60 = .0016), find that fraction on the left-hand scale of the chart, and chart it as a horizontal bar across the day line. Record "0" duration as a ? just below that line. Since corrects are below the record floor in this example, a step or slice back to an easier skill level should be made.



ALL CORRECTS BELOW RECORD FLOOR

COMPLIANCE PROBLEM AT THIS SKILL LEVEL BEFORE?

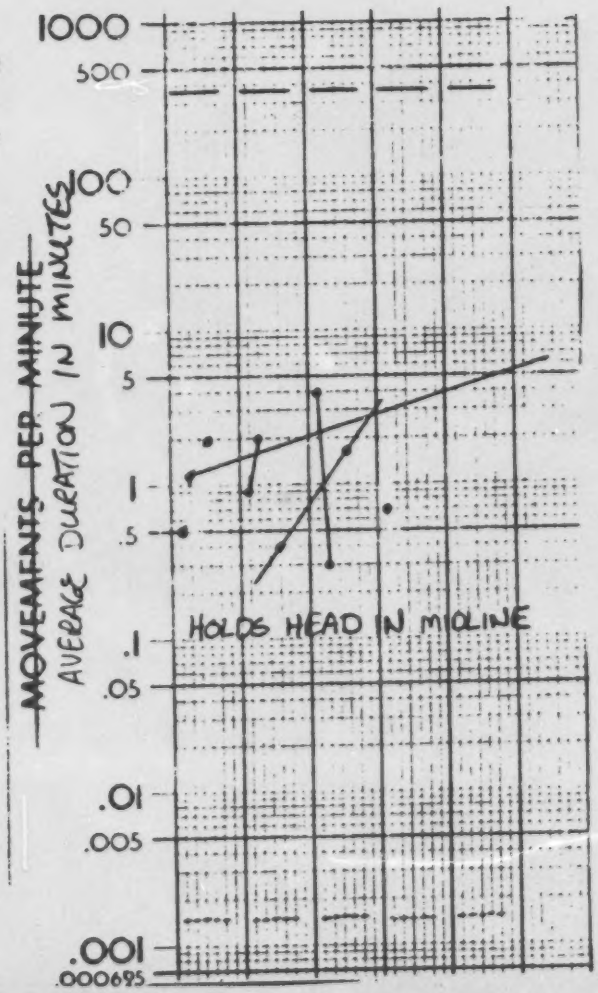
If this is the first phase of your program, the answer to this question is no. If you have ever reached steps (4) or (5) on your flow sheet for the skill your student is currently working on, and the student's performance has not accelerated since, then there is a compliance problem.

CORRECTS ACCELERATING SINCE?

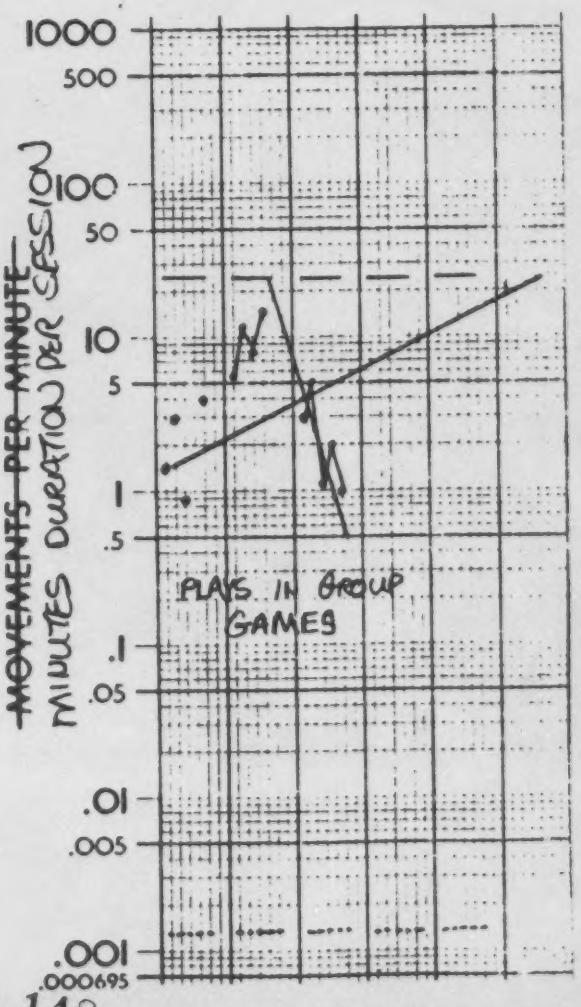
See the examples below if you are uncertain whether or not your student's performance pattern shows high variability or sharp deceleration in corrects.

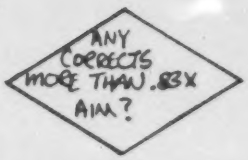
HIGH VARIABILITY OR SHARP DECEL. IN CORRECTS?

HIGH VARIABILITY

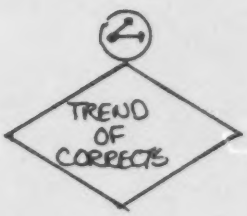


SHARP DECELERATION IN CORRECTS

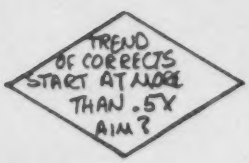




To answer this question, multipy your aim by .83. If <u>any</u> corrects are greater than .83 times the aim of your program, then change your program to motivate student responding. <u>Example</u>: If the aim of your program is to increase playing with peers (e.g., minutes of participation in group games) to the entire 25 minute recess period, the .83 times your aim would be .83 X 25 = 20.75 minutes. If <u>any</u> of the performance data is greater than 20.75 minutes, the answer to this question is <u>yes</u>, and you should turn to page 13 of the Handbook for suggested strategies for fluency building problems.



This refers to the line of progress for your student's data. If it is either flat or accelerating, then there is an acquisition problem in student responding.

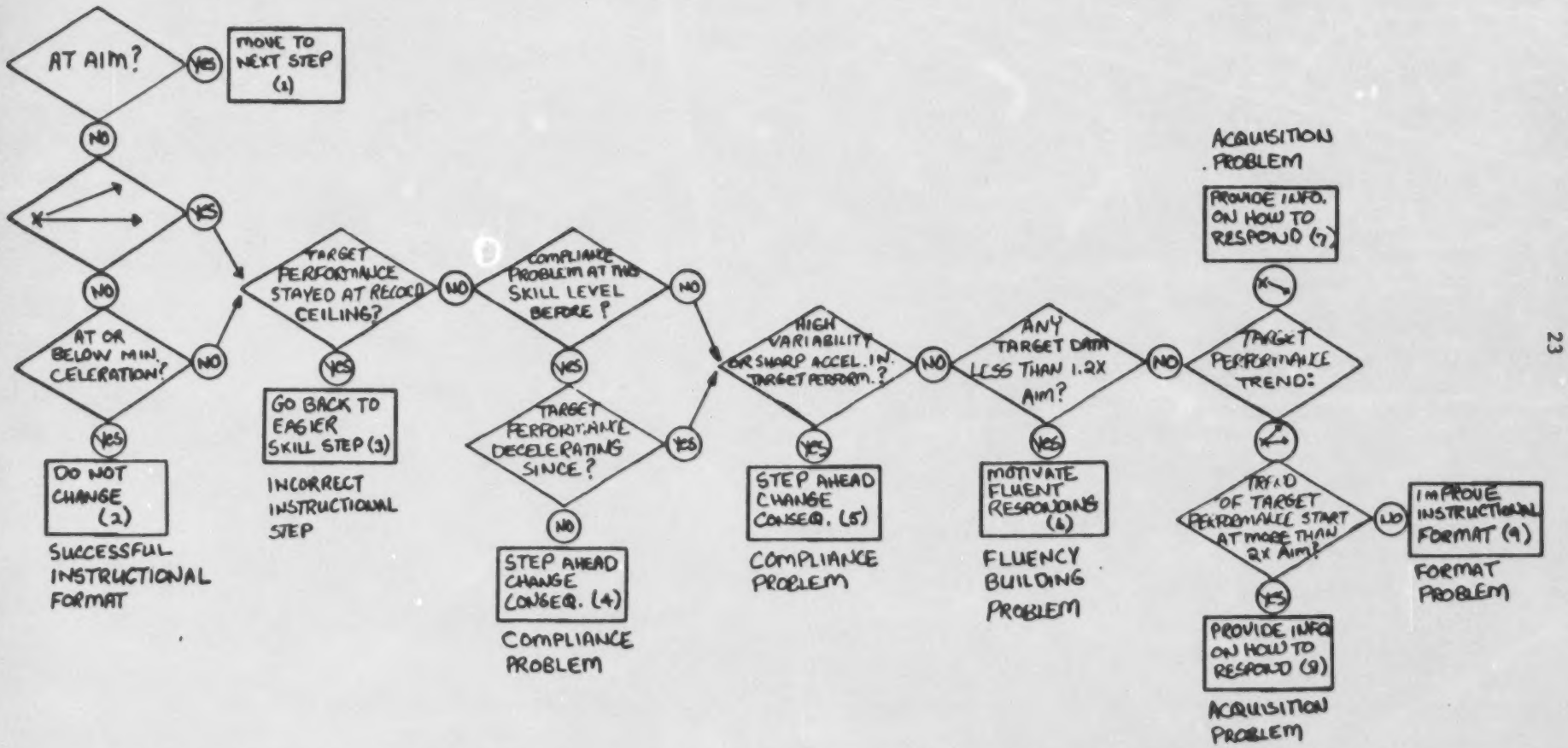


In programs designed to accelerate the duration of student responding, multiply the aim by .5 and estimate the value for the start of the line of progress. If the trend of corrects starts at more than .5 times the aim, then you should change the instructional format. <u>Example</u>: The aim for the peer play program mentioned earlier was 25 <u>min</u>. Multiplying this number by .5 yields 12.5 minutes. If the line of progress starts at more than 12.5 <u>min</u>, then a format problem is indicated.

INSTRUCTIONAL HIERARCHIES RESEARCH PROJECT

University of Washington

Norris Haring, Principal Investigator



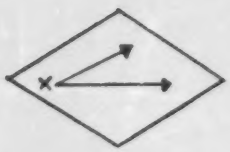
DECELERATE LATENCY AND DURATION OF RESPONDING

EXPERIMENTAL RULES FOR USE WITH MINIMUM CELERATION

SUPPLEMENTAL RULE SHEET: DECELERATE LATENCY AND DURATION OF RESPONDING

The Supplemental Rule Sheet is an expanded text version of the accompanying flow sheet for "Decelerating Latency or Duration of Responding". Each diamond-shaped figure represents a decision point followed by a short explanation which should help you make an instructional decision. Since much of the information has been presented in the two inserts "Using Data Decision Rules" and "Data Types", a quick review of these sheets would be helpful.

If the student has met aim, you should move to the next curricular step or program as soon as possible. If the student has not met aim, go on to the next question.



Is the student progressing? A student may be below the line but not progressing. If you think the student may not be progressing, draw a line of progress for the most recent six days of data. If the line of progress is flat or accelerating, make a change in the instructional program. Refer to the insert on "Using Data Decision Rules with Minimum 'Celeration" for instructions on drawing a new minimum celeration line.

Has the student's performance data been above the minimum 'celeration line for <u>three consecutive days</u>? If so, then it is time to make a change in the instructional program.

If the aim of your program is to decelerate the latency and/or duration of student responding, then you will have already determined the record or performance ceiling for your program. This represents an allowable time limit after which a contingency for no response is implemented. In a latency program, the performance ceiling is usually 5 <u>sec</u>, whereas in programs designed to decrease the duration of student responding (e.g., shoe-tying) the time limit may vary. In either case, if student responses remain at the record ceiling, then you should step back to an easier skill level.

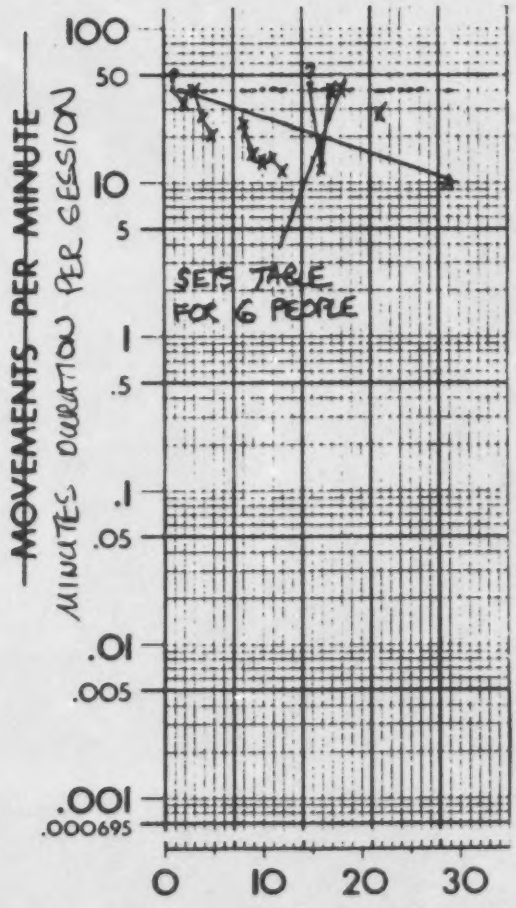
COMPLIANCE PROBLEM AT THIS SKILL LEVEL BEFORE?

If this is the first phase of your program, the answer to this question is no. If you have ever reached steps (4) or (5) on your flow sheet for the skill your student is currenty working on, and the student's performance has not decelerated since, then there is a compliance problem in student responding.

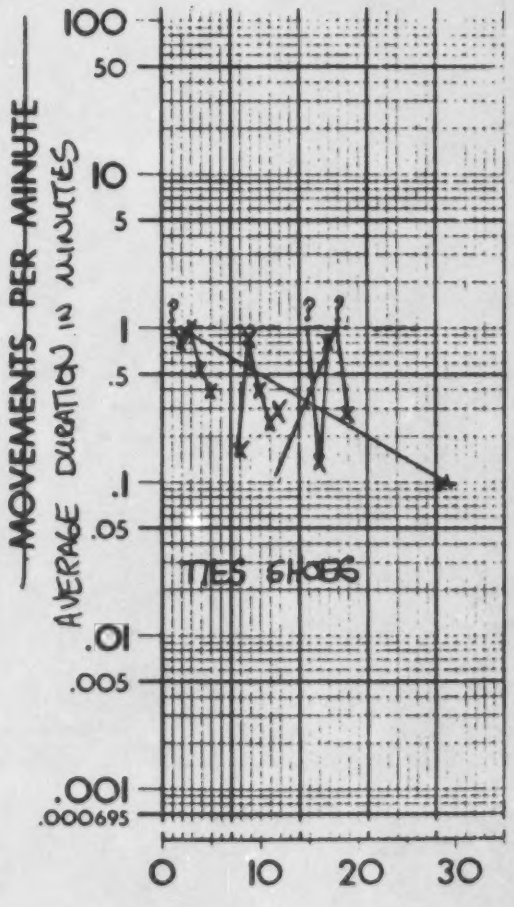
TARGET PERFORMANCE DECELERATING SINCE?

HIGH VARIABILITY OR SHARP ACCEL. IN TARGET PERFORM.?

See the following examples if you are uncertain whether or not your student's performance pattern shows high variability or sharp acceleration in the target performance.

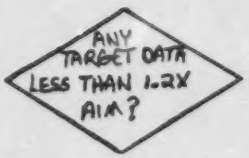


SHARP ACCELERATION



HIGH VARIABILITY

One method for determining high variability in the target performance data involves the use of an ordinary wooden pencil. Take the pencil and place it directly over the line of progress for the target performance data. If the majority of data for the line of progress can be seen around the outline of the pencil, then high variability is indicated. In the shoe-tying program (decelerate duration) on the preceding page, performance has been above the line for three consecutive days and a change in programming is needed. When a pencil is placed directly over the line of progress for the six most recent data, four of the six data points remain visible. In this case, high variability indicates that there is a compliance problem in this program.

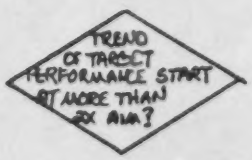


To answer this question for decelerate duration or latency of responding programs, multiply your aim by 1.2 . If <u>any</u> of the performance data is less than 1.2 times the aim of your program, then change your program to motivate student responding. <u>Example</u>: The aim for a shoe-tying program is 6 <u>sec</u> and the student performance closest to the aim is 1 <u>min</u> and 15 <u>sec</u>. First find the decimal equivalent in minutes of 6 <u>sec</u>, and 1 <u>min</u> 15 <u>sec</u>:

$$\frac{6}{60} = .10 \qquad \frac{75}{60} = 1.25$$

Multiply the aim by 1.2 to get .10 X 1.2 = .12 . Since student performance is not less than 1.2 times the aim, the answer to this decision point is <u>no</u>, and you should move to the next decision point on the decelerate duration of responding flow sheet.

This refers to the line of progress for your student's data. If it is decelerating, then student performance indicates an acquisition problem.



In programs designed to decelerate the duration or latency of student responding, multiply the aim by 2 and estimate

the value for the start of the line of progress. If the target performance trend starts at more than twice the aim, then an acquisition problem is indicated. If the performance trend starts at less than twice the aim, then you should change the instructional format. Example: In the shoe-tying program mentioned above, the aim is to decelerate the duration of student responding to 6 sec. Converting this value to a decimal equivalent in minutes gives us .1, and multiplying this value by 2 yields .2 . If the line of progress for the performance data begins at any value less than .2 , and the student is not at aim, then you should change the instructional format.

SITE I

Introduction

Mr. Carl Binder provides preservice and inservice training to teachers in the use of Precision Teaching techniques, and writes and distributes the "Data-Sharing Newsletter". Mr. Binder's interest in decision rules and his five year association with the Instructional Hierarchies Research Project led to his participation in fifth year activities. Mr. Binder provided names and addresses of teachers he had trained in the Northeast, and he then distributed copies of the Handbook of Experimental Procedures to consenting subjects and provided follow-up in the use of the experimental decision rules to subjects who requested assistance.

A total of 46 potential subjects from the New England area were invited to participate in the project. Mr. Binder mailed a list of names and addresses of 38 of the potential subjects to the project and they were then mailed an introductory letter, two copies of the consent form, (see Appendix 1), a Background Questionnaire and postage-paid return addressed envelope. The Handbook of Experimental Procedures and a contact card were mailed to Mr. Binder, who distributed these materials to consenting subjects. Subsequent questionnaires and inserts to the Handbook were mailed directly to subjects by members of the research staff. The names of an additional eight potential subjects were provided by their administrators who contacted the project directly after talking with Mr. Binder. Since these potential subjects were identified fairly late in the project year, they received the Handbook at the same time they received introductory letters, consent forms and Background Questionnaires. Twenty-seven of the 46 potential subjects consented to participate, 10 subjects did not, nine people did not return consent forms. [Return rate 80% (37/46), consent rate 73% (27/37)].

Subjects received no explicit training in the use of experimental procedures, either from Mr. Binder or project staff, although assistance was available upon request.

Method

Subjects

Subjects were 27 teachers from 11 different schools or residences in Massachusetts. Twenty-three subjects worked in private schools or facilities serving a total of approximately 506 handicapped pupils. Two subjects worked in a state school that served approximately 1200 handicapped pupils. Two subjects worked in two public schools serving a total of 47 handicapped pupils. The total number of severely/profoundly handicapped pupils served by all schools was 1,662 and two of the schools were integrated facilities serving both severely/profoundly handicapped pupils and nonhandicapped pupils. Subjects served a total of 254 pupils, including two learning disabled, nine mildly handicapped, 36 moderately handicapped, 93 severely handicapped, 56 profoundly handicapped, 9 multiply handicapped, 8 deaf/hearing impaired and 30 autistic pupils.

Twenty-six of the subjects taught 226 pupils per year, 198 on an average day, with a mean class size of 7.6 pupils (range 2-12). One of the subjects taught 28 moderately handicapped pupils. Teachers usually worked with groups of mixed ages (see Table 1-1).

TABLE I-I

AGE GROUP OF PUPILS SERVED BY SUBJECTS

Pupil Age Group	No. of Pupils	No. of Subjects
Elementary (6-12)	19	2
Mixed Pre-school and Elementary (2-12)	24	2
High School (12-22)	125	11
Mixed Elementary and High School (6-22)	5	1
Above School Age (22+)	4	1
Mixed High School and Older (11+)	77	10
TOTAL	254	27

Teachers averaged 3.8 years teaching experience (range 1-22 years) and 2.9 years in special education (range 1-7 years). Twenty-one of the 27 subjects had training in Precision Teaching. Twenty-four subjects reported some type of assistance in their classrooms. One subject reported 15 assistants, six volunteers, and two students for a total of 476 hours of assistance each week. The other 23 subjects reported a total of 45 assistants, 4 volunteers, 6 student teachers, and 13 others who work a total of 977 hours per week. Of these subjects, the subject with the least amount of help had four hours a week, while the subject with the most help had 96 hours a week. These 23 subjects had an average of three helpers (range 1-5) for an average of 42.5 hours per week (range 4-96 hours). The three teachers who did not have any assistance served two, four, and ten pupils. Twenty of the 27 teachers reported that pupils in their classrooms received some type of therapy for approximately 5.7 hours each week (range 1-30 hours).

Subjects conducted programs on a regular basis in a variety of instructional settings. Twenty-two conducted instructional programs at least once per day, two subjects four times per week and three subjects three times per week. Eight subjects provided five or fewer trials, eleven subjects provided 10-15 trials, one subject provided 16-20 trials and seven provided 20 or more response opportunities. All teachers requested individual responses from their pupils. Eighteen divided their instruction by requesting individual responses in 1:1 sessions, group sessions and natural occasions. Seven subjects spent at least 60% of their time in 1:1 sessions (mean 82%), and two subjects spent 80% and 90% of their instructional time requesting pupil responses at natural occasions for responding. Subjects spent an average of 4.2 hours per week planning (range 1-10 hours).

Evaluation procedures used by subjects at this site included frequent data collection and graphing of pupil performance data. Twenty-one collected data on 95-100% of their instructional programs, two on 85-94%, one on 75-84%, two on 50-74% and one collected data on 10-24% of the instructional programs. Fourteen reported that they collected data every time the program was run and eleven reported they collected data almost every time programs were run. One subject collected data about half the time programs were conducted. Fourteen subjects collected data on every trial, four subjects collected on special probe trials, three subjects on the last

trial only and one on a random number of trials. Twenty-six subjects collected rate data in their classrooms, and for 17 subjects, this was the most frequently used data type. Twenty-two graphed their pupils' performance data.

All subjects utilized decision-rules in at least some programs for deciding when to step ahead and what to do when a pupil met aim. Twenty-two reported rules for deciding when to step back in at least some of their programs, and sixteen reported rules for deciding when and what instructional strategies to change in at least some of their programs.

Training and Follow-up

Mr. Binder acted as an intermediary between subjects and project staff in regards to training during the year. Subjects were free to contact Mr. Binder whenever assistance was needed on adapting the procedures to their classroom or on using the Handbook.

Project staff assisted subjects through phone or mail contact. Assistance to subjects using the procedures in their classroom for a trial period was provided by project staff through phone calls.

Results

Cost of Training

There were no direct training costs for subjects at this site. The cost of mailing the Handbook and other materials was $6.89 per subject, a total of $186.03 for the site.

Evaluation of Handbook

Site 1 subjects did not receive any direct training from project staff or the project intermediary, Mr. Carl Binder, on the use of the decision-rules or the Handbook of Experimental Procedures (Handbook). All 27 subjects who received copies of the Handbook were given the opportunity to evaluate the material in the Handbook through the Handbook Questionnaire. Seventeen of 27 subjects (63%) returned a completed Handbook questionnaire. Subjects spent differing amounts of time reviewing the Handbook. One subject spent one week reading the material, while the other sixteen subjects averaged 3.1 hours (range 1-10 hours).

Each subject rated the clarity of information presented in nine sections of the Handbook on a Likert Scale ranging from 5 (Very Clear) to 1 (Confusing). Some subjects did not respond to all items on the questionnaire. In general, there was a wide range in subjects' ratings, but most sections of the Handbook averaged "4" or better (Table 1-2). Subjects rated sections on "Quick Reference Guides for change strategies" (mean 4.7, range 3-5) and "Fluency Building" (mean 4.5, range 3-5) as the most understandable.

Eleven of 15 subjects wrote additional comments on the overall information presented in the Handbook of Experimental Procedures. Nine of the 11 subjects commented on the format of the Handbook. Three of these subjects said that the overall format was good (e.g., "I'm very impressed with the layout, organization, and clarity of the Handbook.) Two subjects said the general format could be improved (e.g., "You have a boatload of information but it's packaged and presented

awkwardly.") Four subjects said that the format of individual sections of the Handbook needed improvement. Two of these four subjects cited the sections on determining percent correct (e.g., "With the exception of determining percent correct all information in the Handbook is clearly presented) or performance variability. One subject reported that the section on determining sharp deceleration in corrects should be clearer and one subject stated that the "Rules for Rate" were not clear. Two of the eleven subjects commented on the contents of the Handbook. Both of these subjects cited the overall usefulness and importance of the information presented in the Handbook.

Table 1-2

RATINGS FOR CLARITY OF INFORMATION PRESENTED IN THE HANDBOOK OF EXPERIMENTAL PROCEDURES

Content	Ratings	
	mean	range
Using the decision rules (N=17)	4.3	(3-5)
Rules for Rate (N=15)	3.7	(2-5)
Rules for Percent Correct (N=10)	3.0	(1-4)
Quick Reference Guide for Change Strategies (N=17)	4.7	(3-5)
Drawing lines-of-progress, determining percent correct, performance variability and sharp deceleration in corrects (N=17)	3.5	(1-5)
Establishing initial instructional formats (N=17)	4.7	(3-5)
Acquisition (N=17)	4.1	(1-5)
Fluency Building (N=17)	4.5	(3-5)
Compliance (N=16)	4.4	(3-5)
Median Rating	4.3	

Adoption of Procedures

Subjects indicated their decision whether or not to adopt the procedures and experimental rules in their classroom on the Trial Period Questionnaire. Eighteen of 27 subjects (67%) returned a completed questionnaire. Of these, 15 of 18 subjects (83%) agreed to apply the procedures in their classrooms for a trial period.

The three subjects who decided not to adopt the procedures each gave reasons for their decision. One subject was not longer employed. Another subject expressed continued interest and support in the project activities, but explained that his

activities no longer included direct service for handicapped pupils. The third subject felt that the procedures were not applicable to her students or compatible with her instructional procedures, since her ten severely/profoundly handicapped pupils had such low rates of independent responding. Since this subject indicated that her/his instructional and evaluation procedures were compatible with application of the procedures, and since he/she rated the Handbook as very clear, this subjects' decision to not adopt the procedures may be due to a misconception of the application of rate data.

Of the 15 subjects who agreed to try the procedures, seven subjects did not provide information to the project regarding the application of the procedures (see Table 1-3). Four of these did not actually use the procedures, reporting that they "did not have time." One subject, who became an administrator during the project, did not instruct his/her teachers in the use of the procedures as he/she had planned. Two subjects reported using the procedures, but did not return completed Procedures Questionnaires. Thus, of the original 27 subjects, 8 subjects (30%) actually applied the procedures and reorted results to the project.

The eight "yes" subjects included teachers who served a total of 52 pupils, with an average class size of 6.5 pupils (range 2-11). Two of these teachers did not have any assistance in their classrooms, one teacher had 4 hours per week of help, and the other five teachers had a median of 36 hours per week of assistance. The nine "no" subjects generally had larger classes (average class size 10.5 pupils) and more assistance (average 40 hours per week) and more teaching experience (4.52 years vs. 2.1 years for "yes" subjects). Instruction and evaluation methods generally did not differ between the two groups, although five of the 9 "no" subjects did not graph their data. The "no" subjects spent less time reviewing the Handbook and rated it lower (average 4.0) than the "yes" subjects (average Handbook rating of 4.7).

Table 1-3

COST OF TRAINING AND FOLLOW-UP (N = 15)*

Subject #	Agreed to Trial Period	Requested Follow-up	Received Follow-up	Cost of Follow-up[1]	Total Cost of Training & follow-up	Reported on Use of Procedures
5301	X	X	X	$13.04	$19.93	no
5302	X	X	X	$16.99	$23.88	yes
5314	X	X	no	$ 0.00	$ 6.89	no
5321	X	X	X	$ 3.37	$10.26	yes
5326	X	X	X	$15.86	$22.75	no
5327	X	no	no	$ 0.00	$ 6.89	yes
5328	X	X	X	$ 2.28	$ 9.17	no
5332	X	X	no	$ 0.00	$ 6.89	no
5336	X	X	X	$ 9.46	$16.35	yes
5338	X	no	no	$ 0.00	$ 6.89	no
5339	X	X	X	$ 5.82	$12.71	yes
5341	X	X	no	$ 0.00	$ 6.89	no
5342	X	X	no	$ 0.00	$ 6.89	yes
5346	X	no	no	$ 0.00	$ 6.89	yes
5347	X	X	X	$15.47	$22.36	yes

[1] Including long distance charges.

* Three subjects did not agree to use procedures

Follow-up

Eight of the eighteen (44%) subjects returning Trial Period Questionnaires requested follow-up assistance in the Application of the procedures. Of these eight, four actually received technical information. Two of these four eventually returned Procedure Questionnaires (Table 1-3). Each of the other four subjects were contacted by telephone, but, since no questions were asked by the subjects, no technical follow-up was provided. Of these four people, only one returned a Procedure Questionnaire.

Four other subjects requested follow-up assistance during the application of the procedures. A total of 12 of the 18 subjects who returned a Trial Period Questionnaire eventually requested follow-up (67%), eight received technical information and seven reported an use of the procedures (Table 1-3).

Content of the follow-up information included assistance on specific instructional programs (2 subjects), setting aims (2 subjects) and use of the flow chart (2 subjects). Other content included: punishment, noncompliance, determining percent correct, drawing minimum 'cereration lines, use of physical assists, component vs. whole task techniques, deceleration of errors during fluency building, use of the rate plotter, use of Decision Record Sheets, and the application of changing aim strategies.

Cost of Follow-up

Twelve subjects requested follow-up and eight subjects received specific follow-up information (Table 1-3). One subject was provided information in four separate phone calls, one subject in two calls, and one subject in one letter and one call; all other subjects were follow-up in a single phone call (total follow-ups: 12 phone calls and 1 letter). The total cost of the follow-up to eight subjects was $91.75. The cost per subject ranged from $2.28 - 16.99 with a median of $11.25. Of the eight subjects who received follow-up, three did not use the procedures; total cost for these subjects was $40.64. Thus, total follow-up cost for subjects who did use the procedures was $51.11 (Table 1-10).

Application of Procedures

The eight subjects applied the experimental procedures over a total of 69 weeks in 51 instructional programs for 13 different pupils, 27% of the pupils served by these teachers. Five teachers, each of whom taught six pupils, applied the procedures in one or more programs (total 27) for one pupil each. Subject 5327, with nine pupils, applied the procedures to three programs for two pupils, Subject 5321 applied the procedures in 6 programs for four of 11 pupils, and Subject 5302 used decision-rules with both of her/his pupils in a total of 15 programs.

Previously, five subjects indicated that they preferred to collect rate data and three subjects indicated that they preferred to collect accuracy data or counts of behavior; nevertheless, rate data were collected in every program in which the procedures were applied (regular rate in 44 programs, adjusted rate in 7). Six subjects applied the rules using the minimum 'celeration procedure, and two subjects used the method of drawing lines-of-progress every six days and comparing the patterns.

The usefulness of the Handbook to subjects during the application of the procedures was given a median average rating of 4.25 (Table 1-4), as compared to an overall rating of 4.44 prior to application. Changes in ratings during use of the rules are shown in Figure 1-1. Subjects rated the sections of the Handbook concerning technical information necessary for application lower than section dealing with instructional strategies and design.

Table 1-4

USEFULNESS OF THE HANDBOOK

DURING APPLICATION OF THE PROCEDURES

Topic	Rating Mean	Range	
1.	How to Make an Instructional Decision (N=7)	4.43	4-5*
2.	Quick Reference Guides for Change Strategies (N=8)	4.5	2-5
3.	Drawing Lines-of-Progress (N=8)	3.75	2-5
4.	Determining Percent Correct ((N=8)	2.63	1-4
5.	Determing Performance Variability (N=8)	3.13	1-5
6.	Determining Sharp Deceleration in Corrects (N=8)	2.75	2-5
7.	General Considerations for Instructional Formats (N=8)	4.5	4-5
8.	Acquisition (N=8)	4.5	3-5
9.	Fluency-Building (N=8)	4.5	3-5
10.	Compliance (N=8)	4.25	2-5
11.	Median Rating (N=8)	4.25	3-5

Since the technical sections were rated lower, and since no direct training was provided to these subjects, it is not surprising that the subjects generally had some difficulty in the correct application of the procedures. Five subjects shared pupil performance data and evaluation of their application of the procedures showed several major errors: most commonly, subjects did not draw new minimum 'celeration lines following a phase changes and did not make changes when the pupil's performance fell below the minimum 'celeration line.

Prior to the use of the procedures, subjects reported planning for a median of 4.0 hours per week (range 1-10); during the application of the procedures, the median was 3.5 hours per week (range 1-5). Four subjects felt that their planning time increased during application of the procedures, and four felt that it remained the same. In two cases, planning time actually increased, in one case planning time remained the same, and in five cases, the reported planning time actually decreased (Figure 1-2).

Subjects rated their attitude toward the procedures as 4.63 overall (Table 1-5). Due to a research error, no ratings of their attitude prior to application of the procedures were made. These subjects, with previous training in Precision Teaching, gave the highest ratings to collecting and charting pupil performance data.

Table 1-5

SUBJECTS' RATINGS OF ATTITUDE TOWARDS THE PROCEDURES DURING THE TRIAL PERIOD

Topic Ratings (N = 8)

		Mean	Range
1.	Using the procedures when instructional programs are established	4.37	3-5
2.	Collecting performance data	5.00	---
3.	Charting performance data	5.00	---
4.	Drawing Minimum 'celeration Lines	4.43	3-5*
5.	Drawing lines-of-progress in order to apply the rules	4.00	4-5
6.	Using the experimental decision rules	4.50	4-5
7.	Using the change strategies for instructional programs	4.38	3-5
8.	Overall	4.63	4-5

* N = 7 Subjects

FIGURE 1-1

HANDBOOK RATINGS BEFORE AND DURING APPLICATION OF DECISION RULES

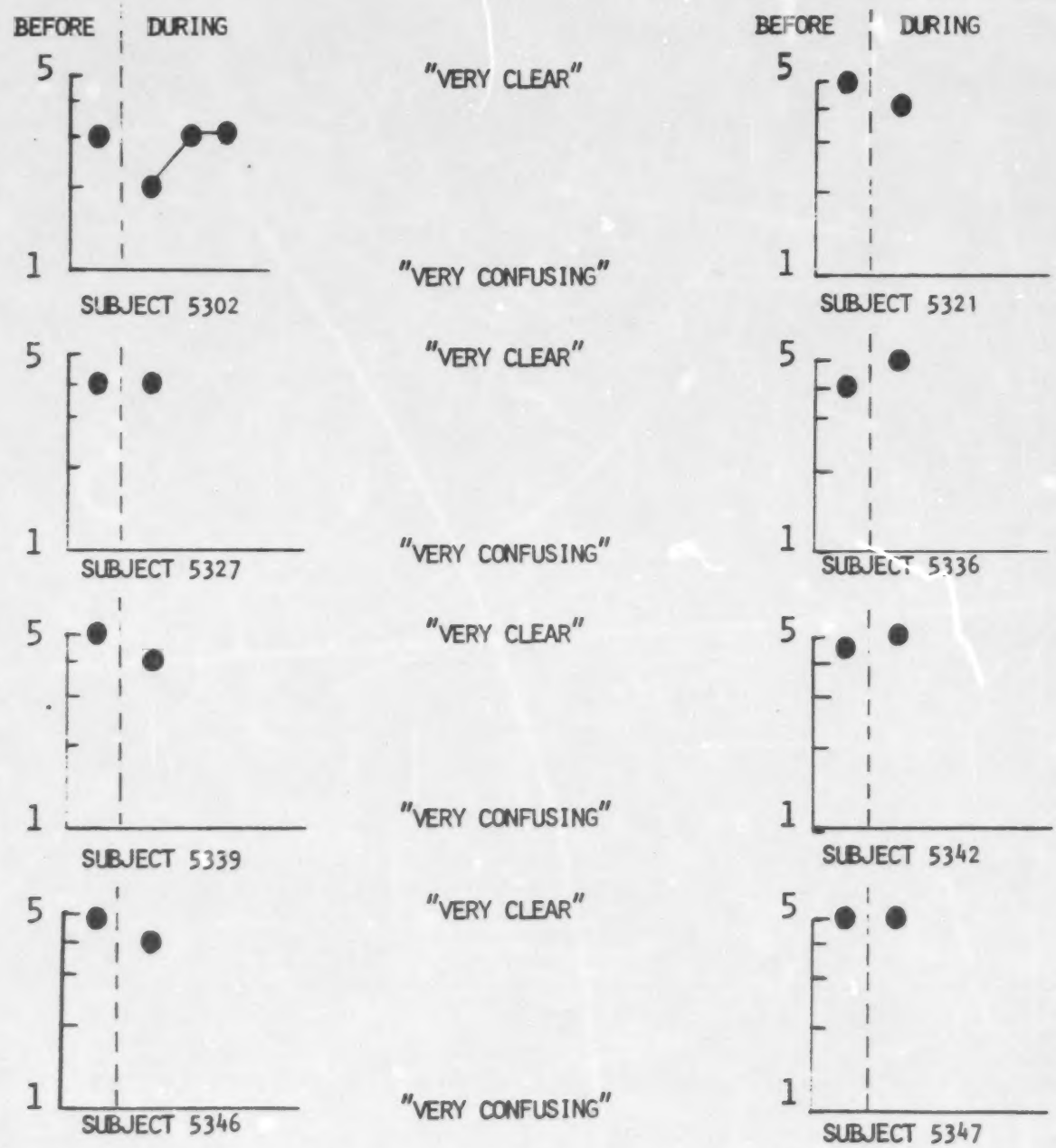
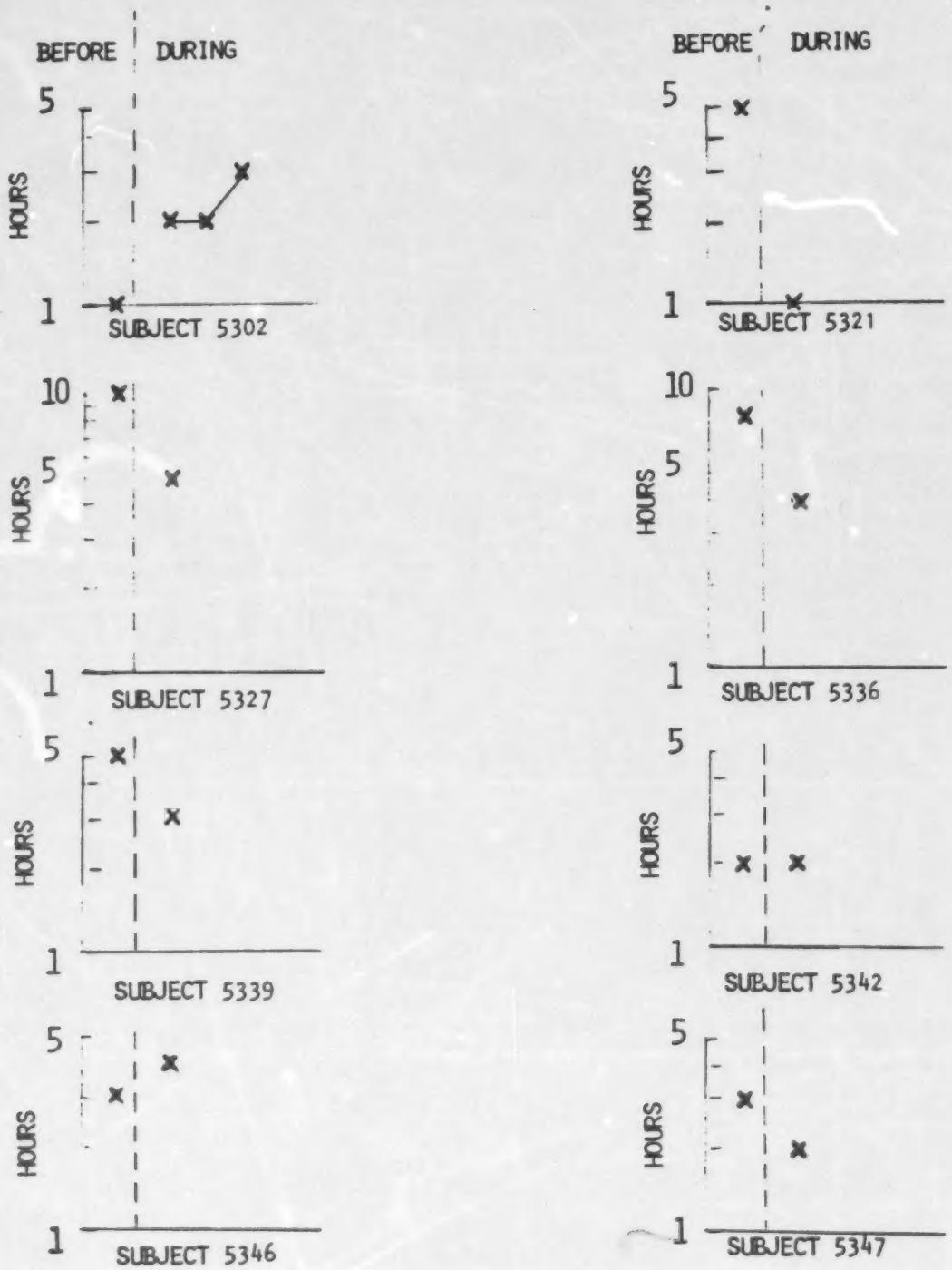


FIGURE 1-2

HOURS PLANNING BEFORE AND DURING APPLICATION OF DECISION RULES



Impact of Pupil Performance

Seven subjects estimated that the decision-rules accelerated pupil performance, while one subject felt they made no difference. Seven of these subjects plan on continuing to use the procedures. The subject who estimated that the procedures made no difference was using the "draw patterns" procedure for application of the decision rules. The other subject using the "draw patterns" method does not plan on continuing to use the procedures, although he/she estimates that they accelerated pupil performance.

Five subjects provided pupil performance data for nine different pupils working on 31 different instructional programs. The instructional programs were aimed at a wide range of behaviors. The targeted movement cycles and the age ranges of the pupils as reported by the subjects are shown in Table 1-6.

Table 1-6

TARGETED MOVEMENT CYCLES IN PUPIL PERFORMANCE DATA

Age Range of Pupils	Movement Cycles*
6-12	Writes digits; writes digits to answer multiplication facts; writes name; says three/four letter words
13-19	Writes digits for addition to 100; writes digits to answer subtraction facts; writes name; writes capital letters; writes digits to answer math facts
14-23	Places cup (right & left hands); releases carrot (right & left hands)
26-27	Lifts knee; takes steps; counts coins; says 1-100; swings arm; counts by 5's; says days of the week; counts dots in array; counts three objects; flexes ankle; bends knee; counts numbers

* Movement cycles are given generally as described by subjects; most subjects counted both correct and error responses, although that distinction is not made above.

Each of the subjects who provided pupil performance data used the minimum 'celeration line method for determining when an intervention should be made, although there were many errors in the application of this procedure. There were instances where subjects did not draw new minimum 'celeration lines following the changes. In phases where there were minimum 'celeration lines, pupil performance fell below the line for three consecutive days on 32 occasions. Less than half the time (15), subjects then made a change; in the majority of these "intervention opportunities" the subject continued with the ineffective procedures. Subjects also changed instructional strategies that were effectively facilitating pupil progress on four occasions. Sometimes subjects did not indicate performance aims on the chart. The lack of aims

on the chart may indicate the lack of any aim for performance; in any case, the pupils of four subjects (all except those of subject 5302) showed almost no progress through the curriculum, with one "step ahead in curriculum" for seven pupils in 16 programs in 723 calendar days (Table 1-7).

These four subjects also made relatively few interventions, 13 in 340 days of data. Three of the subjects used suggested strategies (decision in accord with the rules) everytime they used an intervention, while Subject 5302 followed the rules in 53% of the interventions (Table 1-8). One subject submitted data that could not be analyzed.

Each subject who submitted pupil performance data estimated that the experimental procedures accelerated pupil progress. The percentage of successful interventions ranged from 50% to 100%. Overall, 70% of the interventions were successful, and 50% of the interventions were made in accord with the rule procedures. Subject 5321 submitted pupil performance data covering before and during the application of the procedures (Table 1-9). The six programs with four pupils, the teacher stepped ahead three times but made no strategy changes prior to the use of the experimental rules. During the application of the rules, the teacher stepped ahead once and made six interventions.

Accuracy of the Rules

Notations made by the subjects of the types of intervention strategy changes they made were used to determine whether the change was in accord with the intervention strategies suggested by the rules. In two cases, the description provided by the subject was unclear, and these cases were eliminated from analyses. There were a total 321 changes which were analyzed. The accuracy of the rule in predicting pupil progress was 65% (Table 1-10).

Table I-7

ANALYSIS OF PUPIL PERFORMANCE DATA

Subject	Pupils	Programs	Calendar Days	Data Days	Phases	Step Aheads	Inter-ventions	Usable	#Successful	%Successful	Subject's Estimate of Impact of Procedures
5302	2	15	1767	668	71	13	29	22	15	68%	Accelerated
5321	4	6	267	134	15	1	6	6	5	83%	Accelerated
5339	1	4	214	122	8	0	6	4	2	50%	Accelerated
5346	1	4	132	55	5	0	1	1	1	100%	Accelerated
5347	1	2	110	29	3	0	0	0	-	-	Accelerated
TOTAL	9	31	1757	739	102	13	58	34	24	71%	

Table 1-8

UTILIZATION OF SUGGESTED STRATEGIES

Subject	# Interventions	# Usable	# Successful	% Successful	# Using Suggested Strategy	% Using Suggested Strategy	Predictability of Rules
5302	28	22	15	68%	8	53%	60%
5321	6	6	5	83%	6	100%	83%
5339	6	4	2	50%	4	100%	50%
5346	1	1	1	100%	1	100%	100%
5347	1	0	-	-	-	-	-
TOTAL	43	33	23	70%	19	58%	65%

Table 1-9

INDIVIDUAL PUPIL PROGRESS BEFORE AND DURING APPLICATION OF EXPERIMENTAL RULES

			Before Use of the Rules					During Use of Rules					
Subject	Pupil	Behavior	Data Days	Step Aheads	Av. Days To Step Ahead	Inter-ventions	% Success Interven-tions	Data Days	Step Aheads	Av. Days To Step Ahead	Inter-vent-ions	% Success Interven-ions	% Follow Rules
5321	1	writes digits	38	1	38	0	?	13	0	?	1	100%	100%
	1	writes mult. facts	25	0	?	0	?	27	1	27	1	100%	100%
	2	says three letter words	31	1	31	0	?	28	0	?	1	0%	100%
	3	writes name	41	0	?	0	?	28	0	?	1	100%	100%
	4	writes digits	41	1	41	0	?	12	0	?	1	100%	100%
	4	writes mult. facts	30	0	?	0	?	26	0	?	1	100%	100%

Table 1-10

ACCURACY OF RULES FOR INTERVENTION CHANGES

	Pupil Progress Actually Accelerated	Pupil Progress Actually Did Not Accelerate
Changes made in accord with a rule (Prediciton that progress will be accelerated)	48%* (N=15)	13% (N=4)
Changes made not in accord with a rule (Prediction that progress will not be accelerated)	23% (N=7)	16%* (N=5)

*Concurrence of prediction and actual results indicates rule accuracy: total 20/31=65%.

Cost Analysis. The total cost for providing Handbooks and follow-up to 27 subjects in this site are shown in Table I-11. Of the 27 subjects, eight actually utilized the procedures in their classrooms for a total of 13 pupils over 91 weeks. If all site costs are included, these figures result in an average per pupil cost of $10.29 during the experimental period of application, or approximately $3.05 per week.

If costs are separated to include only those costs incurred by subjects who utilized the procedures, these figures are reduced to a median cost of $6.89 per pupil and $1.33 per week (Table I-12). For subjects who applied the procedures, the cost per program per week averaged $.13. Figures for each subject vary considerably (Table I-12), and would have been considerably lower if subjects had involved more pupils in their application of the experimental procedures.

Table I-11

COST SUMMARY

No. Subjects Participating	:	27
Total Handbook Costs	:	$186.03
Total Follow-up Cost	:	$ 91.75
TOTAL SITE COST	:	$277.78
Av. Per Subject Cost	:	$ 10.29
Av. Per Pupil Cost*	:	$ 21.37
Av. Per Week Cost**	:	$ 3.05

* Includes N=13 pupils whose teachers applied the procedures in instructional programs
** Includes N=91 weeks during which teachers applied procedures

Table I-12

COSTS FOR SUBJECTS APPLYING PROCEDURES DURING EXPERIMENTAL PERIOD

Application of Procedures				Costs			Cost Analysis			
Subject	Weeks	Pupils	Programs	Handbook	Follow-up	Total	Per Pupil	Per Program	Per Program/Week	
5302	18	2	15	$ 6.89	$16.99	$ 23.88	$11.94	$ 1.59	$1.33	.09
5321	8	4	6	6.89	3.37	10.26	2.57	1.71	1.28	.21
5327	6	2	3	6.89	0	6.89	2.45	2.30	1.15	.38
5336	8	1	7	6.89	9.46	16.35	16.35	2.34	2.04	.29
5339	6	1	2	6.89	5.82	12.71	12.71	6.35	2.12	1.06
5342	11	1	10	6.89	0	6.89	6.89	.69	.63	.06
5346	6	1	4	6.89	0	6.89	6.89	1.72	1.15	.29
5347	6	1	2	6.89	15.47	22.36	22.36	11.18	3.73	1.86
TOTAL	91	13	49	$55.12	$51.11	$106.23				
MEDIANS						$ 11.48	$ 6.89	$ 1.59		$1.33

SITE 2

Introduction

The subjects from Site 2 were given the opportunity to participate in the project through a cooperative arrangement between the Center for Inservice Training and Program Development (CITPD) and the Instructional Hierarchies Research Project. The CITPD provides services for severely and profoundly handicapped students and their families through a demonstration center and training programs. The training activities include two three-week Summer Workshops[1], three one-day mini-workshops and follow-up assistance to trainees, with a major content emphasis on systematic instruction and the integration of services through a "comprehensive education team" (See Appendix 2 for a more complete description of CITPD). CITPD identifies prospective schools and districts throughout the Western Region for participation in the training program. Special education directors for these districts are sent information describing CITPD and given the opportunity to send a team from their district for training.

Prior to the two workshops, all prospective subjects identified by CITPD were sent: a letter from the IH project describing the project and inviting their participation; a letter from the CITPD supporting the research project; two copies of the Site 2 consent forms; the Background Questionnaire, and a postpaid return-addressed envelope (Appendix 2).

Forty-eight consent forms and Background Questionnaires were mailed to participants of the June and July workshops. Twenty-seven consent forms were returned prior to the workshops. Consent forms and Background Questionnaires were also available to participants at both workshops prior to training in the experimental procedures. Twenty-one participants of the June workshop agreed to serve as subjects, four did not consent and one did not return the form or attend the workshop. Sixteen participants at the July workshop agreed to serve as subjects, three did not consent and three did not return the form or attend the workshop. A total of 37 participants agreed to be subjects.

As part of the cooperative agreement, the IH Project agreed to provide training to CITPD staff members in data collection, charting, and the experimental decision rules prior to the June and July workshops and to conduct a training session for all workshop participants (not just consenting subjects) at the two workshops on the experimental procedures. Although CITPD staff had planned to train all participants in the use, collection, and charting of different data types, this training was provided by IH staff.

During the workshop, all participants were required to attend "general" sessions and practica and free to choose among a variety of "menu" sessions (see agenda in Appendix 2). Training provided by the IH project at both the June and July workshops consisted of a large group "general" session and two "menu" sessions. All workshop

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[1] Workshops were conducted by the Center for Inservice Training and Program Development (CITPD) and sponsored by the Washington State Office of Public Instruction; the Center for the Severely Handicapped and the Western Region Inservice Training Project (two projects funded through the Bureau of Education of the Handicapped, Department of Education), and the University of Washington, College of Education, Area of Special Education.

participants attended the general session, which was a one hour presentation titled "Decision Rules: What to Change" and consisted of an overview of the experimental procedures. Two "menu" sessions, titled "Data Decisions" and "Instructional Procedures", each 1½ hours long, were offered at both workshops. Thirty-one subjects attended the sessions offered by the IH staff; 17 in June and 14 in July.

Method

Subjects

Subjects who consented to project participation were from 14 schools in nine school districts in the states of Louisiana, Texas and Washington. The schools included 10 public schools, one state school, two state institutions and one private residential school. Seven of the schools served both nonhandicapped and handicapped pupils, ranging from mildly handicapped to profoundly handicapped. The other seven schools served handicapped pupils exclusively.

Twenty-three of the 37 subjects were classroom teachers. One teacher also had some administrative duties. Twelve subjects were therapists, including four physical therapists, four occupational therapists, and four communication disorders specialists. Although administrators were not originally considered as potential subjects, two subjects expressed an interest in learning the procedures in order to teach the 13 professionals they supervised, and were included as subjects.

The twenty-three teachers served about 220 pupils per year. Twenty-two teachers served a total of 178 pupils on an average day, with an average class size of 8.1 pupils (range 5-14), and approximately 200 pupils per year. One subject served 20 learning disabled pupils in a resource room. Subjects served pupils with a variety of handicapping conditions (see Table 2-1), although the majority were moderately or severely handicapped.

Table 2-1

PUPILS SERVED BY CONSENTING SUBJECTS: SITE 2

Subjects	Learning Disabled	Mildly Handicapped	Moderately Handicapped	Severely Handicapped	Profoundly Handicapped	Multiply Handicapped	Other*	Total Pupils
Teachers N=22	10	25	33	85	42	7	2	204
Therapists N=12	29	49	118	60	46	4	76	382
Total N=34	39	74	151	145	88	11	78	586

*Communication disorders (70) Orthopedically handicapped (8)

An average of 35 preschool-aged pupils were served in five classrooms, 61 elementary pupils (aged 6-12 years) were served in six classrooms and 76 high school students were in seven classrooms. Three classrooms also served a total of 30 pupils in mixed age groups of 6 to 22 years, and two classrooms served 18 students older than 22 years.

Therapists served a total of 405 pupils per year and 148 on an average day, ranging from 2 years to older than 22 years. The mean number of pupils served by a therapist per day was 12.3 (range 5-20).

Twenty-two teachers had previous teaching experience (mean 5.8 years, range 1-28 years) and all had experience in special education (mean 5 years, range 1-21 years)[2]. Therapists were slightly more experienced than the teachers. Mean number of years in education for therapists was 7.2 years (range 1-23 years), and 6.9 years in special education (range 1-23 years). The two administrators each reported having supervised professionals serving sph pupils for one year. Formal training in Precision Teaching was reported by four teachers, one therapist and one administrator.

Twenty-one teachers and eight therapists had some assistance in their classrooms. These subjects reported a total of 35 paid assistants, 20 volunteers, 34 student teachers and 50 other people, for a total of 1213 hours each week. The two teachers who reported the most help had help for 85 hours per week, while the teacher with the least amount of help received 11 hours of assistance per week. These 21 teachers had an average of 5.7 persons providing some type of help for an average of 43 hours per week, and all teachers reported that their pupils received some form of therapy in addition to regular classroom activities. Eight therapists had assistance. The average number of assistants for each therapist was 2.4 for an average of 38.6 hours per week (range 7-20). Neither of the administrators reported having assistants.

There were many points of similarity in the instruction provided by the teachers. Eighteen teachers ran instructional programs at least once per day. Eight teachers ran programs less often: two teachers ran instructional programs four times a week, four teachers ran programs three times a week, one teacher twice a week, and another teacher ran programs whenever a natural occasion for the behavior occurred. Six teachers provided pupils with five or fewer response opportunities, five provided five to nine trials and ten provided 10-15 trials.

While all teachers reported spending some instructional time requesting individual responses in a 1:1 setting, nine teachers spent the majority of their instructional time in a 1:1 setting. Two teachers spent 50% or more of their instructional time requesting individual responses from pupils in a group setting, and two teachers spent 50% or more of their instructional time requesting individual responses at natural opportunities. Two teachers spent at least 50% of their instructional time requesting unison responses in group settings and one teacher reported spending the majority of her/his time doing feeding and maintenance tasks. Six other teachers divided their time equally between two instructional settings. Three of these teachers spent an equal amount of time requesting individual responses in group settings and at natural opportunities, two spent equal time requesting individual responses during 1:1 instruction and group settings and another teacher divided her/his time equally between individual responses in 1:1 settings and at natural

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[2] One teacher had no previous teaching experience and did not complete parts 3 and 4 of the Background Questionnaire.

opportunities. The average planning time was 4.5 hours per week (range 1-12) except for one subject, who reported spending 20 hours per week.

Instruction conducted by therapists differed from that of the teachers. Therapists generally conducted their instructional programs less frequently than the teachers: four therapists ran programs once or twice per week and six therapists ran programs once, twice or three times per week. Only two therapists ran programs once or twice per day. Three therapists provided pupils with five or fewer response opportunities, three provided five to nine trials, four 10-15 trials and two 20 or more trials.

Like the teachers, all of the therapists spent some of their instructional time requesting individual responses in a 1:1 setting. Nine therapists spent 50% or more of their time working with pupils in a 1:1 setting and one therapist spent 50% or more of his/her time requesting individual responses in a group setting. Two therapists divide their time between requesting individual responses during 1:1 instruction and group settings. The therapists spent an average of 2.6 hours per week planning instructional programs (range 1-8 hours), which was considerably less time than the teachers reported.

Fifteen of 22 teachers collected data on at least 75% of their programs (median category was 85-94%). Three teachers collected data on 50-74% of their programs, two on 25-49% and two on less than 10%. Nineteen teachers collected data every time or about every time a program was run, and three teachers collected data about half the time the program was run. Eighteen teachers collected data on every trial, three on a random number of trials and one on all trials during a set amount of time.

The most frequent data type collected was accuracy data, with 16 teachers ranking it first. Five teachers selected count of behaviors as their preferred data type and another teacher selected count of trials. Of the eight teachers who graphed data, two had formal training in Precision Teaching. The majority of teachers had specific rules for moving to the next step and changing when at aim for all or some of their programs. Four teachers reported rules for when to change instructional procedures and three had rules for selecting intervention techniques for all programs.

Seven therapists collected data on at least 85% of their instructional programs, two therapists collected data on 75-84% of their programs, one on 50-74%, and two therapists collected data on less than 24% of their instructional programs. Six therapists collected data every time or about every time a program was run. One therapist collected data about half the time a program was run, and four therapists collected data only for initial assessment purposes. One therapist collected data every time a program was run with a severely/profoundly handicapped pupil, about every time a program was run with a moderately handicaped pupil, and collected only initial assessment data when working with mildly handicapped pupils.

Three therapists collected data on every trial, one therapist collects data only on the first trial, three collect data on a random number of trials, three on special "probe" trials and another therapist collected data on all trials during a set amount of time. One therapist collected data on every trial for programs run with severely/profoundly handicapped pupils and on special "probe" trials only for programs run with moderate and mildly handicapped students.

Four therapists collect count of behavior data. Three other therapists collected accuracy data most frequently, two collected levels of assistance most frequently, one

count of trials, and one collected rate data most frequently. One therapist collected measures of pulmonary functioning.

Like the teachers, the majority of therapists reported specific rules for moving to the next step (N=11) and changing when at aim (N=10) for at least some programs. Only one therapist reported rules for deciding how to modify instructional procedures or when to change the instructional strategies during a program.

Training Procedures

All workshop participants, including the subjects, attended a one hour general session, "Data Decision Rules," which covered the history of the IH Project, the need for decision-rules, prerequisites for using the rules and examples of rule application to pupil performance data. Since CITPD emphasized the use of percent correct data, these data and rules were presented in the general session. (Rules utilized the "drawing patterns" approach, as detailed in the General Procedures Section). Participants were taught how to draw lines-of-progress and apply the rules to percent correct data, the data type promoted during the CITPD sessions. Participants practiced drawing patterns and applying the rules, and received handouts on "Rules for Percent Data", drawing lines-of-progress for six data days and examples of charted data for practice.

Subjects were provided additional training in two "menu" sessions, each offered twice at each workshop. The first of these sessions, "Data Decisions," was 1½ hours long. Groups of five, twelve, six and eight subjects attended those sessions (N=31). (Six subjects dropped from the project at this time.) The content of this session included an introduction to different data types, methods for collecting and charting rate, latency, and duration data, and an introduction to using rules with rate data. Subjects practiced drawing lines-of-progress for five and seven data days and using the rules with examples of charted data.

The second "menu" session, "Instructional Procedures", also 1½ hours long, was attended by groups of eight, nine, eight and six subjects. Content included descriptions of instructional strategies for initial instructional formats for both acquisition and fluency-building, and strategies appropriate to acquisition problems, fluency-building problems, and compliance problems. At the conclusion of this third session, each subject was asked to evaluate the training (Presentation Questionnaire). All 31 subjects then received the Handbook of Experimental Procedures.

Revisions and additions to the Handbook were mailed to the subjects during the fifth project year. These included the modified rules for use with the minimum 'celeration procedure for rate, duration and latency data, and a written description of how to collect and chart these data types.

Follow-up

Follow-up to Site 2 subjects was provided by both the IH staff and CITPD staff during the 1979-80 school year. The IH Project follow-up was provided through telephone and mail by members of the research staff. Throughout their involvement with the project, each subject was encouraged to call (collect) whenever any questions, concerns or problems arose. Subjects were called at their request or to prompt return of project questionnaires.

Follow-up provided by CITPD was determined by a contract completed prior to participation in the training. The contract consisted of a set of objectives and a time-line by which the team members of each district agreed to meet the objectives. A trainer from the CITPD was assigned to coordinate follow-up assistance to each team. This technical assistance consisted of a minimum of six, one-day visits to each team, inservice presentations, and telephone contacts as requested by the subjects. In contrast to the follow-up assistance provided by the IH project, the CITPD staff assisted mainly by direct contact with the subjects. The assistance varied from small group discussions to individual meetings between the trainer and the subject.

Data Collection

Changes were made in the Presentation Response Questionnaire for subjects at both workshops. Two questions were changed on the Presentation Response Questionnaire for subjects at the June workshop: Question 3, Part 1, was deleted because all information on charting data was presented by CITPD. In Question 5, Part 1, "lines-of-progress" replaced "patterns". Items of the Presentation Response Questionnaire were reorganized for subjects attending the July workshop, but the content remained unchanged. The new questionnaire was similar to the order in which the information was presented at the IH sessions.

Results

Evaluation of Training

Thirty-one subjects completed a Presentation Questionnaire following attendance at three training sessions by the IH staff. Twenty teachers, nine therapists and two administrators completed the Presentation Questionnaire.

The overall rating on clarity of the information presented was high, with the therapists' ratings slightly higher (mean 4.8, range 3-5) than the teachers' (mean 4.4, range 3-5). The administrators' ratings were 4 and 5.

The subjects also rated the clarity of information presented on specific topics: establishing initial instructional formats; collecting data; drawing lines-of-progress; decision rules; types of changes in instructional procedures, and using the Handbook (Table 2-2). Ratings for the teachers, therapists and administrators were very similar. In only two cases were ratings below 3. Information on collecting data (June Workshop subjects only) and drawing lines-of-progress were considered to be the most clearly presented information, while information presented only at the July Workshop on collecting and charting data was considered to be the least clearly presented information.

Subjects who had had previous training with Precision Teaching Techniques (N=4) did not tend to rate the clarity of information higher than those who had not had this training. On the other hand, those subjects who generally used specific criteria for modifying insructional programs (N=21) rated the clarity higher in all categories than did those subjects who used few or no rules.

Sixteen subjects wrote comments on the training procedures. These subjects most frequently wrote that they considered the information on the experimental procedures to be very valuable and practical, and that the presentation format was good and well organized. Two teachers expressed some concern about the amount of new information presented. One teacher requested more examples and three therapists suggested allowing more time for presenting the material.

Table 2

SUBJECTS' RATINGS OF CLARITY OF PRESENTATIONS

Presentation Topic	Teacher Rating N=20		Therapist Rating N=9		Admnistrator Rating N=2	All Subjects N=31	
	mean	range	mean	range		mean	range
General purpose of procedures	4.3	(3-5)	4.4	(4-5)	4,4	4.2	(3-5)
Collecting data*	4.7	(4-5)	4.7	(4-5)		4.7	(4-5)
Collecting and charting data**	4.3	(4-5)	4,5		2.4	3.9	(2-5)
Drawing lines-of-progress	4.6	(3-5)	5.0		3,4	4.2	(3-5)
Using decision-rules	4.4	(3-5)	4.3	(3-5)	4,5	4.5	(3-5)
Establishing instructional formats	4.3	(3-5)	4.3	(3-5)	4,5	4.4	(3-5)
Instructional procedures	4.3	(3-5)	4.3	(3-5)	4,5	4.4	(3-5)
Implementing instructional strategies**	4.2	(3-5)	4,4		4,5	4.2	(3-5)
Using the Handbook	3.8	(2-5)	4.0	(3-5)	3,5	4.0	(2-5)
Overall	4.4	(3-5)	4.8	(3-5)	4,5	4.5	(3-5)

*June Workshop participants only: teachers, N=10; therapists, N=7
**July Workshop participants only: teachers, N=10; therapists, N=2; adminstrators, N=2

Attitude Following Training

Subjects rated their general attitude towards the experimental procedures following training (Table 2-3). Ratings of the 20 teachers and nine therapists were the same (mean 4.4, range 3-5 and 4-5, respectively). Both administrators rated their attitude as 4. Teachers rated the usefulness of the procedures at 4.6 (range 3-5) and the therapists ratings were slightly higher (mean 4.8, range 4-5). Both administrators rated the usefulness of the procedures as 4.

Subjects also rated the material presented on how applicable the procedures may be to their particular educational setting (Table 2-3).

The subjects' ratings of the applicability of material were compared on a number of variables. The frequency with which subjects ran programs did not appear to be related to how subjects rated the applicability of the material. However, subjects who collected data almost every time a program was run, or who collected data on at least 95% of their instructional programs, rated the applicability higher than those subjects who collected data less frequently. Subjects who charted their pupil performance data rated the applicability of the information on collecting and charting data higher than those subjects who do not chart performance data.

Table 2-3

SUBJECTS' ATTITUDE TOWARD THE EXPERIMENTAL PROCEDURES

	Teacher Rating N=20		Therapist Rating N=9		Admnistrator Rating N=2	All Subjects N=31	
	mean	range	mean	range		mean	range
General Attitude	4.4	(3-5)	4.4	(4-5)	4,4	4.4	(3-5)
Usefulness of Procedures	4.6	(3-5)	4.8	(4-5)	4,4	4.6	(3-5)
Applicability: Overall	4.5	(3-5)	4.2	(3-5)	4,5	4.4	(3-5)
Designing initial instructional formats	4.3	(3-5)	4.3	(3-5)	4,5	4.4	(3-5)
Conducting instructional programs	4.5	(3-5)	3.5	(2-5)	4,5	4.3	(2-5)
Collecting data	4.6	(3-5)	4.3	(3-5)	4,5	4.5	(3-5)
Charting data	4.5	(3-5)	4.4	(3-5)	4,5	4.5	(3-5)
Using decision-rules	4.7	(3-5)	4.8	(4-5)	4,4	4.4	(3-5)
Changing instructional methods	4.7	(4-5)	4.6	(4-5)	4,5	4.6	(4-5)

Cost of Training

Total training cost for Site 2 subjects was $1,885.49, $62.15 a piece for June Workshop participants who had slightly longer training time, and $59.21 for each July Workshop subject. This total cost includes teacher and trainer costs for the time spent attending training sessions ($1,552.04 and $116.76 respectively) and cost of materials given to subjects during the sessions ($216.69).

Follow-up After Training

Twenty-three subjects requested additional information following training in the experimental procedures. Fifteen teachers requested information in all areas except on "drawing performance patterns". The most frequently requested area of information was selecting a data type (eight teachers) and using decision-rules (six teachers). One teacher also requested information on compliance and eliminating inappropriate classroom behaviors.

Four therapists requested additional information. Three therapists requested information on charting performance data. One therapist requested information on how to collect data, chart data, and select instructional procedures for students with communication disorders in regular education.

Six of the 23 subjects met individually with one member of the IH research staff following the presentations to provide the requested information. These meetings lasted approximately 10 minutes each, and were held within one week of the conclusion of training. Eighteen subjects requested information to be provided in the fall when the school year began. All 18 were contacted by phone, although some were provided help after they had actually begun to use the procedures. The follow-up conversations lasted approximately five minutes with the teachers (range 1.5 - 10 minutes) and four minutes with the therapists (range 1.5 -10 minutes), and 10 minutes with each administrator.

Cost of First Follow-up

The total cost was $61.30 of which $36.12 was for the visits, and $25.18 for the phone conversations.

Evaluation of Handbook

The thirty-one subjects who completed training were asked to rate the clarity of information presented in the Handbook of Experimental Procedures. The Handbook Questionnaire was completed by a total of 14 subjects, including 10 teachers, three therapists and one administrator. The overall return rate for this questionnaire was 45%, higher for teachers and administrators (50%) than for therapists (33%).

The fourteen subjects spent a median of 2 hours (range .25 - 8 hours) reviewing the Handbook of Experimental Procedures. Teachers generally spent more time reviewing the Handbook than therapists, which may be because teachers felt that the experimental procedures were more applicable to their educational setting than the therapists (from Presentation Response Questionnaire). The one administrator spent five hours reviewing the Handbook.

Teachers, therapists and the administrator all rated the information in the Handbook of Experimental Procedures as 3, 4, or 5 (Table 2-4). The sections on

drawing lines-of-progress, determining percent corect, performance variability and sharp deceleration in corrects were rated slightly less clear (mean 4.1) than general considerations for instructional formats and information on acquisition (mean 4.6).

Six teachers, three therapists and the administrator wrote additional comments concerning the Handbook. These subjects most frequently wrote that they considered the information very helpful, practical and that the format was good. Two teachers expressed some concern about the amount of new information they had to deal with and apply to their educational settings. There was one request for a Table of Contents or an Index.

Table 2-4

RATINGS OF CLARITY OF INFORMATION IN HANDBOOK OF EXPERIMENTAL PROCEDURES

Content	Teacher Rating N=10		Therapist Rating N=3	Admnistrator Rating N=1	All Subjects N=14	
	mean	range			mean	range
Using Decision-Rules	4.4	3-5 (N=9)	4,4,5	4	4.4	3-5 (N=13)
Rules & Quick Reference Guide for Rate Data	4.4	3-5	3,4,5	4	4.3	3-5
Rules & Quick Reference Guides for Percent Correct Data	4.4	3-5	3,4,5	4	4.3	3-5
Quick Reference Guides for Change Strategies	4.4	3-5	3,4,5	4	4.4	3-5
Drawing Lines-of-Progress, & Determining Percent Corect, Performance Variability, & Sharp Deceleration in Corrects	4.1	3-5	3,4,5	4	4.1	3-5
General Considerations for Instructional Formats	4.6	3-5	4,4,5	5	4.6	3-5
Information on Acquisition	4.5	4-5	4,5,5	5	4.6	4-5
Information on Fluency-Building	4.3	3-5	3,4,5	5	4.3	3-5
Information on Compliance	4.4	3-5	4,5,5	5	4.5	3-5
Median Rating	4.5		4.3	5	4.5	

Adoption of Procedures

Thirty-one subjects were mailed a Trial Period Questionnaire, which asked subjects whether they planned to implement the experimental procedures in their educational settings. Eighteen subjects returned the Trial Period Questionnaire (return rate: 58%). Eleven subjects (61%), agreed to a trial period for the procedures in their classroom ("yes" subjects). These eight teachers and three therapists served a total of 169 pupils. Seven subjects (38%) did not agree ("no" subjects); four teachers, two therapists and an adminstrator.

Subjects who decided not to try the experimental procedures each gave a variety of reasons for their decision. Subjects usually stated that they did not have enough time to adopt the procedures, although one teacher reported insufficient time to report to the research project. One therapist reported that the procedures were incompatible with his/her curriculum and instructional procedures. One teacher decided not to adopt the procedures because he/she didn't know how to apply procedures to his/her educational situation, and another teacher said he/she could not see the need to use the procedures. These four subjects had previously rated the experimental procedures as applicable (4) following the training presentations. Other comments included personal reasons, and moving to a new district.

The "yes" and "no" subjects were compared on a number of variables. There were almost no differences between the two groups in terms of the amount of adminstrative and peer support in the subjects' educational setting. While both groups served the same types of handicapped pupils, the "yes" subjects had larger classes (8.5 pupils vs 7.7 pupils) and more assistance (46 hours per week vs 40 hours), spent more time planning (3.7 hours vs. 3 hours) and were more likely to graph their data.

Some differences in instructional practices existed between the two groups of subjects. "Yes" subjects collected data on a greater percentage of instructional programs (91% "yes" subjects vs 28% "no" subjects collect data on at least 85% of programs) and ran programs more frequently (64% vs 43% ran programs daily) than the "no" subjects. "Yes" subjects also ran more trials in an instructional program than "no" subjects (64% vs 14% run 10 or more trials).

The "yes" and "no" subjects were also compared on their responses on the Presentation Response Questionnaire and on the Handbook Questionnaire. "Yes" subjects rated their general attitude, and the usefulness and overall applicability of the experimental procedures higher than the "no" subjects. Mean ratings for the "yes" and "no" subjects were 4.6 vs 4.2 on general attitude, 4.7 vs 4.6 on usefulness and 4.6 vs 4.1 on overall applicability.

While the average "yes" subject spent more time than the average "no" subject reviewing the Handbook (3 hours vs 2 hours), the "yes" subjects consistently rated the Handbook lower on all sections than the "no subjects. The median ratings for the "no" subjects were 4.8 (range 4.3-5.0) compared to 4.2 (range 3.8-4-5) for the subjects who agreed to a trial period.

Of the eleven subjects who agreed to try the procedures, five either did not return questionnaires, or reported that they did not use the procedures. The six subjects who used the procedures included five teachers and one therapist. The six subjects served a total of 71 pupils per year (Table 2-5).

Table 2-5
PUPILS SERVED BY SUBJECTS USING PROCEDURES

Subject	No. Pupils	Age Range	Handicapping Condition
5207	7	6-11	severely handicapped
5101	5	2-3	severely handicapped
5108	8	16-21	moderately, severely and profoundly handicapped
5112	9	4-6	mildly and moderately handicapped
5116	7	3-5	severely handicapped
6171	35	5-19	moderately, severely and profoundly handicapped

The five teachers all had some classroom assistance, ranging from 76 hours per week to 30 hours per week. The therapist did not have assistance.

Additional Follow-up

Ten follow-up contacts were made to four subjects using the procedures: one visit, eight phone calls and one letter. Follow-up information included compliance (3 subjects), information on the use of the Decision Record Sheets (3 subjects), clarification of minimum 'celeration lines (2 subjects) and information on selecting data types, setting aims, use of latency data, and designing initial instructional formats.

Cost of Additional Follow-up

The follow-up costs during the trial period were $82.68. These costs include $10.87 for the visit, $4.71 for the letter, and $67.10 for the phone calls (see Table 2-13 for per subject costs).

Application of Procedures

The five teachers applied the procedures with 30 pupils in 95 programs for a total of 118 weeks (42% of the total pupils served by these teachers). Two teachers reported once, one teacher reported twice, one reported three times and one teacher reported on four separate Procedures Questionnaires. The therapist used the procedures for 18 weeks in 3 programs with 2 pupils (6% of the pupils served by this subject). The therapist reported once.

The five teachers had indicated prior to application of the rules that they preferred to collect accuracy data, and the therapist generally used counts of behavior. During the application of procedures, four teachers and the therapist collected accuracy data, although two of these teachers also collected some rate and duration data. One teacher collected rate data. Of the 95 programs, percent correct data were collected in 76 cases (80%), rate data in 9 cases (9%) and duration data in 10 cases (11%). One teacher and the therapist used the rules and procedures taught

during the workshops: drawing patterns for percent correct data. Two teachers used minimum 'celeration lines and applied rate rules to percent correct data. One teacher tried both the minimum 'celeration and draw patterns rules for percent correct data. One teacher used the draw patterns procedures with rate data as taught at the workshops.

The usefulness of the Handbook to subjects during the application of the procedures was given a mean average rating of 4.5, identical to the mean average rating of these six subjects prior to the use of the Handbook. As before, the technical sections (e.g., determining percentage correct, drawing lines of progress, determining sharp variability) were ranked lower than sections on general instructional procedures (Table 2-6) except for Fluency-Building; possibly since few subjects moved pupils into fluency-building program procedures. Changes in ratings are shown in Figure 2-1. Despite the lower ratings of the technical sections, two of the three subjects who shared pupil performance data used the rules correctly.

Table 2-6

USEFULNESS OF THE HANDBOOK

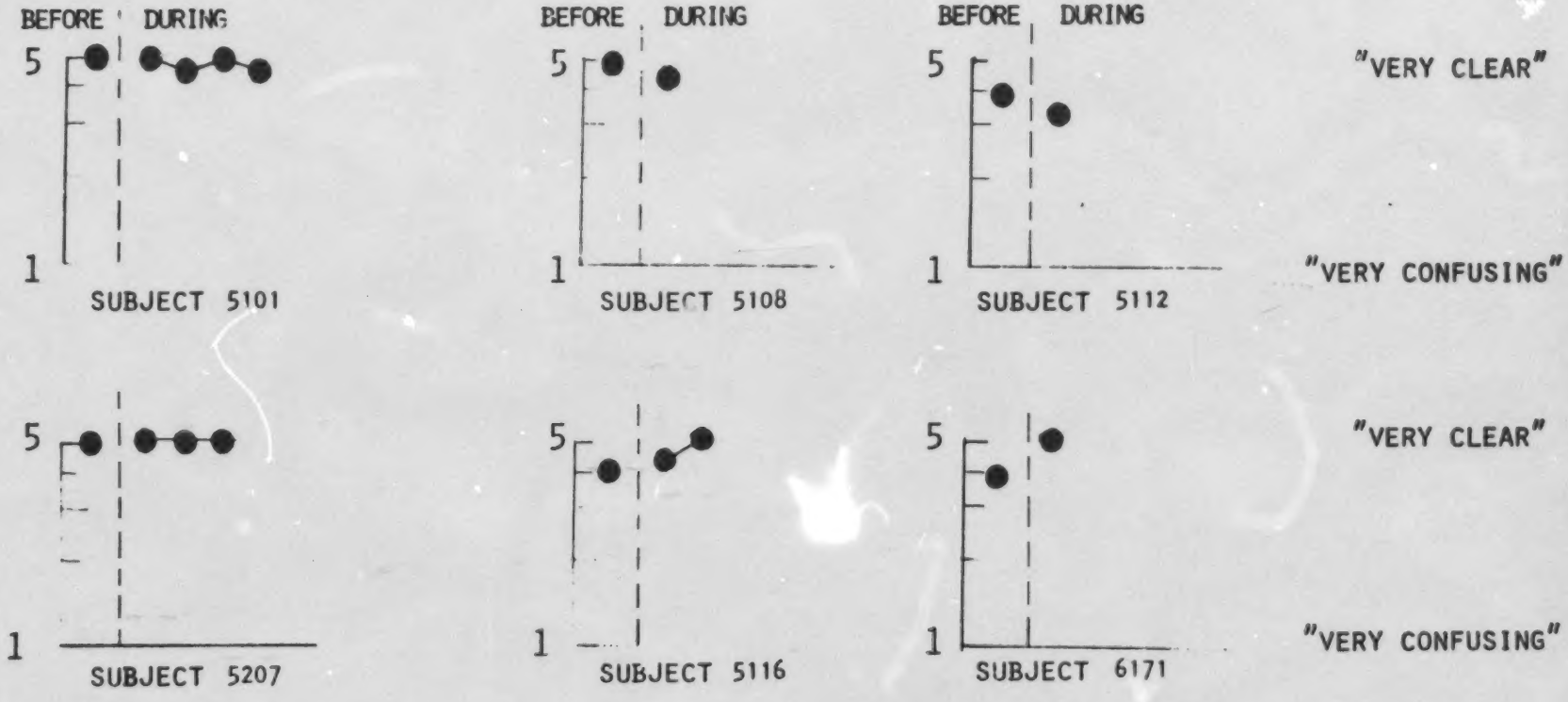
DURING APPLICATION OF THE PROCEDURES

N=6

Topic		Rating	
		Mean	Range
1.	How to make an Instructional Decision	4.33	3-5
2.	Quick Reference Guides for Change Strategies	4.83	2-5
3.	Drawing Lines-of-Progress	3.5	2-5
4.	Determining Percent Correct	3.6	1-5
5.	Determining Performance Variability	2.8	1-5
6.	Determining Sharp Deceleration in Corrects	4.0	2-5
7.	General Consideration for Instructional Formats	4.8	4-5
8.	Acquisition	4.67	3-5
9.	Fluency-Building	4.0	3-5
10.	Compliance	4.83	4-5
11.	Median Rating	4.5	

FIGURE 2-1

HANDBOOK RATINGS BEFORE AND DURING APPLICATION OF DECISION RULES



Prior to the use of the procedures, subjects reported planning for a median of 3.5 hours per week (range 1-5); during the first application of procedures, the median was 3 hours per week (range 1-5). One teacher spent more time, one teacher spent the same amount of time, and four others spent less time planning during the period they were applying the rules (Figure 2-2).

Five of the six subjects rated their overall attitude toward the procedures as 5 prior to application; of these five, three eventually ranked their attitude lower during actual application (Figure 2-3). The subject who had ranked the procedures as 4.0 prior to application ranked his/her attitude as 5.0 following application. The therapist gave the lowest overall rating to the procedures, and ranked charting and drawing lines-of-progress as 3 and 1 respectively.

Impact on Pupil Performance

Four subjects estimated that the procedures accelerated pupil performance, while one subject estimated that pupil progress decelerated, and one estimated that it accelerated in some programs and decelerated progress in other programs. Both of these latter two subjects applied the rules to percent correct data. All of the subjects plan on continuing to apply the procedures.

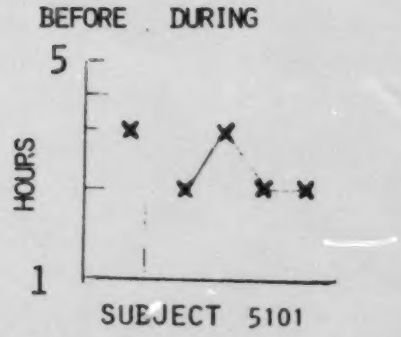
Three subjects shared pupil performance data on a total of 19 pupils in 52 programs, including a wide variety of target behaviors (Table 2-7).

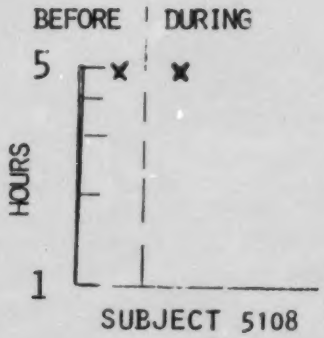
Subject 5101 submitted percent correct data on many programs. According to this subject, the experimental decision rules were applied in all programs. However, no evidence of the application of rules was found in the data of nine programs (Table 2-8). Rules for rate data applied with the minimum 'celeration procedure were used in eleven programs, and the draw patterns procedure and the percent correct rules were used in 4 programs. The charted data indicate that Subject 5101 may not have applied the rules correctly: programs were not changed when the pupil met performance criterion; changes were not made either when performance patterns were decelerating (draw patterns procedure) or when performance fell below the minimum 'celeration line, and patterns and minimum 'celeration lines were not drawn for many of the phases.

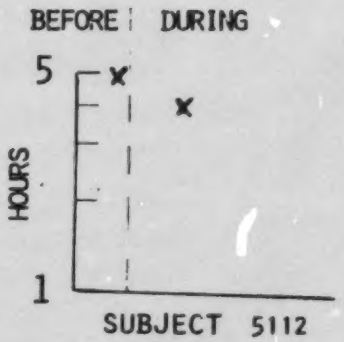
The four programs in which the draw patterns procedure was used covered a total of 93 days of data (Table 2-9) and there were a total of seven patterns drawn, when 13 could have been drawn using seven day lines-of-progress, or 18 using five day lines-of-progress. In 11 programs Subject 5101 applied rules using the minimum 'celeration procedure. Interventions were generally made late, when the pupil was more than three days below the line, or not at all (six programs had no intervention changes). Of the 9 usable interventions, all accelerated pupil progress, and the rules were accurate in 60% of the cases which could be analyzed (Table 2-10). This subject estimated that the rules accelerated pupil performance. A comparison of programs in which there is no evidence of rule application and those in which the rules were

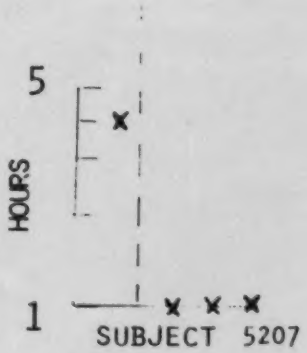
FIGURE 2-2

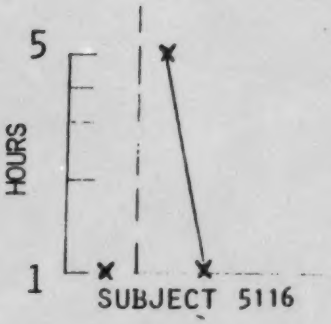
HOURS PLANNING BEFORE AND DURING APPLICATION OF DECISION RULES











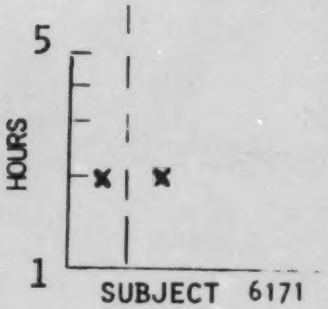


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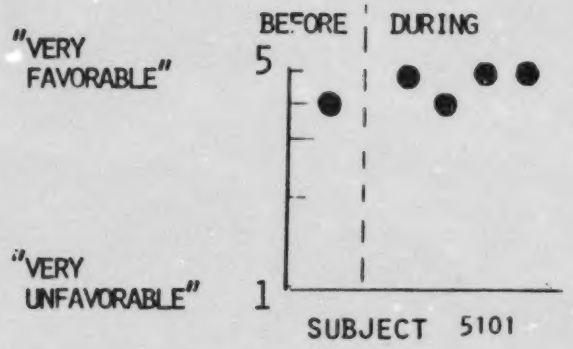
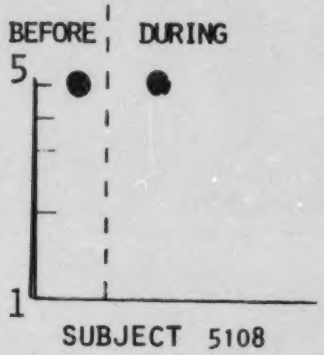
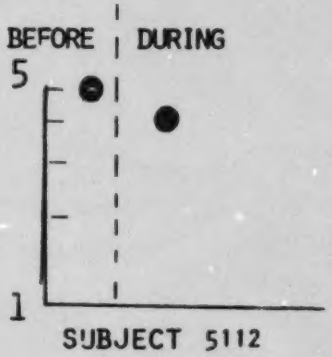
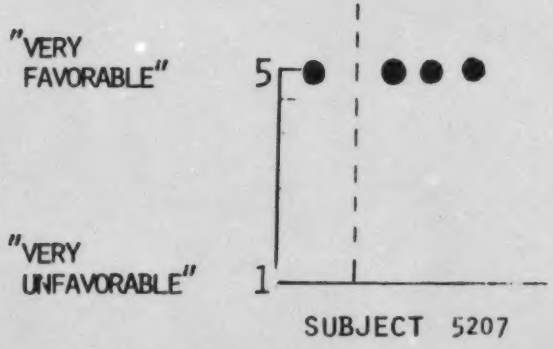
FIGURE 2-3

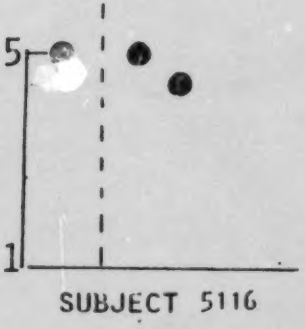
ATTITUDE TOWARD PROCEDURES BEFORE AND DURING APPLICATION OF DECISION RULES

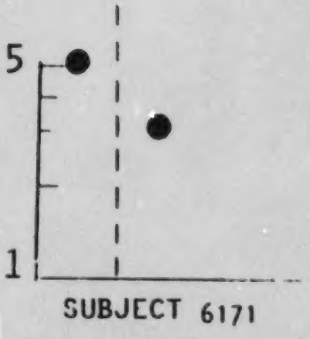












applied with minimum 'celeration procedures indicates that the rules may have increased the number of interventions made by Subject 5101. However, since the target behaviors are different, it is impossible to draw any conclusions.

Subject 5108 applied the rules for rate using the minimum 'celeration procedure to percent correct data, and generally applied the rules correctly: stepping ahead when the student was at aim 27 or 27 times, and changing instructional strategies 12 of the 16 times pupil performance fell below acceptable progress. In those four instances, the subject drew new minimum 'celeration lines rather than change instructional procedures. Eleven of the sixteen interventions made in 25 programs were successful (69%) (Table 2-9). Subject 5108 utilized the suggested strategy 69% of the time, and the rules were 75% accurate in predicting the outcomes of decisions (Table 2-10). The 25 programs included five programs over a total of 351 calendar days and 155 days of data in which no changes of any kind were made. This subject estimated that the use of the procedures accelerated pupil performance.

Subject 5207 also applied the minimum 'celeration procedure and rules for rate data to percent correct data, and generally applied the rules correctly: stepping ahead when the student was at aim 17 of 20 times, and changing instructional strategies nine of 11 times pupil performance fell below the minimum 'celeration line. Subject 5207 applied the rules in 91% of the opportunities, 91% of the interventions were successful, and the rules predicted the impact of interventions 82% of the time (Tables 2-9 and 2-10). In one case, the subject did not follow the rules and pupil performance improved. In another case, the subject followed the strategy change, but had drawn the minimum 'celeration line incorrectly and made a change when one was not required. The change failed to improve pupil performance.

As a group, the three subjects who shared pupil performance data collected 481 days of data in 48 programs, and made 92 changes. Of the 92 changes, 54 were changes made to move the pupil forwad in the curriculum and 38 were strategy changes. Eighty-four percent of the changes were made in accord with the rules, 83% of the changes were successful, and the rules accurately prediced the outcomes of the changes in 77% of the cases.

Accuracy of the Rules

Notations made by the subjects of the types of strategy changes they made were used to determine whether or not an intervention was made in accord with the strategies included in the rules. Thirty-one of the 35 usable interventions included clear descriptions of strategies; the other four changes were eliminated from this analysis. The predictability of the rules for each subject varied: 60% for 5101, 75% for Subject 5108 and 82% for Subject 5207. The accuracy of the rules in each case are shown in Table 2-11.

Cost Analysis

The total costs for training 31 subjects in this site are shown in Table 2-12. Of the 31 trained subjects, six actually utilized the procedures in programs for thirty pupils over a total of 18 weeks. If all site costs are included, these figures result in an average per pupil cost of $65.47 during the experimental period of application, or approximately $17.20 per week as the costs of applying the experimental procedures.

If costs are separated to include only those costs incurred in training subjects who actually then used the procedures, these figures are reduced to a median cost of

$8.49 per pupil and $4.08 per week (Table 2-13). For subjects who applied the procedures, the cost per program per week averaged $.23. Figures for each subject vary considerably (Table 2-13), depending on the numbers of pupils and programs and length of time the subject applied the procedures.

Table 2-7

TARGETED MOVEMENT CYCLES IN PUPIL PERFORMANCE DATA

Age Range of Pupils	Movement Cycles
1-4	grasps toy; pulls toy by string; rolls ball; plays "push 'n go"; puts object in container; cruises; walks in walker; plays musical instrument; takes sock off; strings beads; holds cup; imitates play; rides tricycle; puts object in foam template; touches ball; points to named object; props self up on elbows; stands; responds to auditory stimuli; responds to tactile stimuli; points to named picture; opens hands; turns head to touch.
6-10	matches object to picture; matches colors; take and put pens in jar; take shirt off; matches objects; puts pants on; responds to name; scoops food.
16-21	collates sheets; give requested no. pennies; puts paper in folder; assembles sifter; sorts objects; puts shirt on; reaches for noise maker; plays with toys; says "beside box" "cup to cups" "shoe to shoes"; counts out 4 pieces.

Table 2-8

INDIVIDUAL PUPIL PROGRESS ON PROGRAMS BEFORE* AND DURING APPLICATION OF EXPERIMENTAL PROCEDURES

SUBJECT 5101

		Before Use of the Rules*					During Use of Rules					
Pupil	Behavior	Data Days	Step Aheads	Av. Days To Step Ahead	Inter-ventions	% Success Interven-tions	Data Days	Step Aheads	Av. Days To Step Ahead	Inter-vent-ions	% Success Interven-ions	% Follow Rules
1	grasp toy	29	0	?	2	0%						
1	put obj. in						52	1	52	4	100%	?
1	appropriate play	23	2	12	0	?	20	1	20	1	100%	0%
2	cruise	3	met aim									
2	walk in walker	7	met aim									
2	plays rhythm instrument						21	0	?	0	?	?
2	sock off						53	2	26	1	100%	100%
3	string beads	7	met aim									
3	drinks	22	1	22	0	?						
	imitate play	16	1	16	0	?						
5	ride trike	27	1	27	0	?						
5	put in						35	1	35	2	?	?
5	string beads						40	3	13	0	?	?
5	touch ball						25	0	?	0	?	?
6	props on elbows	28	0	?	0	?						
6	"prone board"						35	1	35	0	?	?
6	respond to tactile stimulation						31	1	31	0	?	?
6	respond to auditory stimulation						46	0	46	1	100%	0%
7	turn head						55	0	?	2	100%	100%

*Programs in which no evidence of the application of the rules appears in pupil performance data

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Summary

median data days = 25

prog. w/changes (S.A. or inter) = 5 of 6

prog. w/S.A. = 4 of 5

median days to step ahead = 18

prog. w/inter = 1 of 5, 0% successful

20% of changes were interventions

median data days = 35

prog w/changes = 9 of 11

prog. w/S.A. = 7 of 9

median days to step ahead = 31

prog. w/inter = 6 of 9

67% of changes were interventions

Table 2-9

ANALYSIS OF PUPIL PERFORMANCE DATA

Application of the Draw Patterns Procedure

Subject	Pupils	Programs	Calendar Days	Data Days	# No Patterns Drawn	# No Change Patterns	# Change Procedure Patterns	Interventions	# Successful Decision	% Successful
5101	4	4	276	93	7	4	3	1	3	43%

*Subject estimated that the procedures accelerated pupil performance, 57% utilization of suggested changes, predictability of rules, was 57%.

Application of the Minimum 'Celeration Procedures

Subject	Pupils	Programs	Calendar Days	Data Days	Phases	Step Aheads	Interventions	Usable	#Successful	%Successful	Subject's Estimate of Impact of Procedure
5101	6	11	1021	413	30	7	11	9	9	100%	Accelerated progres
5108	7	25	1774	838	69	27	16	16	11	69%	Accelerated progres
5207	6	11	987	310	41	20	11	11	10	91%	Accelerated progres
TOTAL	19	48	3782	481	140	54	38	35	30	86%	

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Table 2-10

UTILIZATION OF SUGGESTED STRATEGIES

Subject	# Interventions	# Usable	# Successful	% Successful	# Using Suggested Stragegy	% Using Suggested Strategy	Predictability of the Rules
5101	11	9	9	100%	3 of 5*	60%	60%
5108	16	16	11	69%	11	69%	75%
5207	11	11	10	91%	10	91%	82%
TOTAL	38	36	30	83%	24	84%	77%

*Phase notes for four phases were incomplete or illegible and so these phases were excluded from analysis.

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Table 2-11

ACCURACY OF RULES FOR INTERVENTION CHANGES

	Pupil Progress Actually Accelerated	Pupil Progress Actually Did Not Accelerate
Changes made in accord with a rule (Prediction that progress will be accelerated)	64% (N=21)	9% (N=3)
Changes made not in accord with a rule (Prediction that progress will not be accelerated)	15% (N=5)	9%* (N=3)

*Concurrence of prediction and actual results indicates rule accuracy: total 24/32=75%.

Table 2-12

COST SUMMARY

ALL COSTS

No. Subjects Trained	:	31
Total Training Costs	:	$1885.49
Total Follow-up Cost	:	$ 143.98
TOTAL SITE COST	:	$2029.47
Av. Per Subject Cost	:	$ 65.47
Av. Per Pupil Cost*	:	$ 67.64
Av. Per Week Cost**	:	$ 17.20

* Includes N=30 pupils whose teachers applied the procedures in instructional programs
** Includes N=118 weeks during which teachers applied procedures

Table 2-13

COSTS FOR SUBJECTS APPLYING PROCEDURES DURING EXPERIMENTAL PERIOD

Application of procedures				All Costs			Cost Analysis			
Subject	Weeks	Pupils	Programs	Training	Follow-up	Total	Per Pupil	Per Program	Per Week	Per Program/Week
5101	28	9	40	$ 62.15	14.28	$ 76.43	$ 8.49	$ 1.91	$ 2.73	$ .07
5108	11	8	25	$ 62.15	$ 2.16	$ 64.31	$ 8.04	$ 2.57	$ 5.85	$ .23
5112	13	3	3	$ 62.15	$ 1.65	$ 63.80	$ 21.27	$ 4.91	$ 1.64	
5116	17	1	2	$ 62.15	$ 7.27	$ 69.42	$ 34.71	$ 4.08	$ 2.04	
5207	31	7	16	$ 59.21	$ 78.34	$ 137.55	$ 19.65	$ 8.60	$ 4.44	$ .27
6171	18	2	3	$ 59.21	$ 0.00	$ 59.21	$ 29.60	$ 9.87	$ 3.29	$ .55
TOTAL	118	30	95	$ 376.08	$ 103.71	$ 470.72				
MEDIANS						$ 66.87	$ 8.49	$ 2.57	$ 4.18	$ .23

47

SITE 3

Introduction

The participation of the teachers and therapists working with severely handicapped pupils in the Olympia, Washington, school district was discussed with Dr. Stillman Wood, Director of Special Services for Olympia. Dr. Wood, who has long advocated the use of Precision Teaching in the district, indicated that special educators and their advisors in the district were familiar with the research project and wanted to receive inservice training on the use of decision-rules. An arrangement between the Olympia School District and this project was made: project staff would train the advisors of all special educators in the use of the decision-rules and the Handbook of Experimental Procedures, while teachers and therapists of "developmentally disabled" pupils (including multiply, severely, profoundly and moderately handicapped pupils) would be invited to participate as subjects.

A four hour training session with the advisors was conducted by Dr. White, Dr. Liberty, and Ms. Martin on August 28, 1979. Topics discussed during the session included a history of the development of data decision-rules, the use of decision-rules with minimum 'celeration, decision-rules for use with rate and percent correct data, and different types of intervention strategies. Advisors were given an opportunity to practice drawing lines-of-progress and received a handout on different data types. A copy of the Handbook of Experimental Procedures was distributed to each of the six advisors who attended. At the conclusion of the meeting it was decided that the advisor for the teachers serving developmentally disabled pupils would arrange a meeting with those teachers prior to the start of the school year to discuss their participation in the project.

A 45 minute meeting with teachers and therapists serving pupils labeled "developmentally disabled" was held on October 10, 1979 by Dr. White and Dr. Liberty. Following a general introduction by Dr. Stillman Wood, Dr. White presented a history of the decision-rules and Dr. Liberty gave a short overview of the project. Eight potential subjects were given copies of the consent form (Appendix 3-1) and Background Questionnaire and asked to complete and return the forms by mail if they wished to participate in the project. Additional forms for potential subjects who were unable to attend the meeting were distributed by their advisor. A total of 13 subjects eventually consented to participate in this year's research.

In comparison with other sites, the training received by subjects at Site 3 was generally the least extensive, except for Site 1. The majority of subjects were trained in two large group sessions, three subjects were trained in small group sessions, and make-up sessions were scheduled for those who couldn't make the regular sessions. Subjects were also provided follow-up assistance, by project staff during their participation in the study.

Method

Subjects

The 13 subjects included nine teachers, two communication disorders specialists, and one occupational and one physical therapist.[1] One of the seven teachers had no

[1] Two consenting teachers did not return Background Questionnaires or other questionnaire and are not included in demographic information provided in this section.

previous experience, while the six experienced teachers averaged 6.7 years teaching (range 1-13 years) and 4.3 years teaching special education (range 1-10 years). Six of the seven teachers had prior training in Precision Teaching. The four therapists averaged 4.5 years (range 1-8 years) in special education. Two of the four therapists had prior training in Precision Teaching.

The seven teachers served a total of 63 pupils per year and 59 on an average school day. The mean class size was 8.4 pupils with a range of 6-12 pupils. Most teachers served a mixture of pupils labeled either moderately, severely or profoundly handicapped (Table 3-1). The four therapists served a total of 124 pupils per year, and a total of 40 on an average day. Client load was 7, 6, 10 and 17. The age ranges of the pupils served are shown in Table 3-2, with most of the classrooms serving preschool or elementary school pupils.

Table 3-1

PUPILS SERVED BY CONSENTING SUBJECTS: SITE 3

Subjects	Learning Disabled	Mildly Handicapped	Moderately Handicapped	Severely Handicapped	Profoundly Handicapped	Other*	Total Pupils
Teachers N=7	0	7	23	18	14	0	62
Therapists N=4	3	17	25	44	10	10	109
Total	3	24	48	62	24	10	171

*Communication disorders

Table 3-2

AGES AND APROXIMATE SCHOOL LEVELS FOR PUPILS SERVED BY SUBJECTS: SITE 3

No. Pupils	Ages (in years)	School Level	Subjects
27	2-6	Preschool	2 teachers
23	6-12	Elementary	3 teachers
13	12-22	High School	2 teachers
75	1-12	mixed	2 therapists
49	1-18	mixed	2 therapists

As a group, the teachers had more help available in their classrooms than did the therapists. Each of the seven teachers reported some assistance. There was a total of 11 paid assistants, four volunteers, four student teachers and eight other people assisting teachers for a total of 369 hours per week. The subject with the most help had 10 people helping for 122 hours per week, while the subject who reported the least help had one person assisting for 29 hours per week. In general, teachers had approximately four persons providing some type of assistance for an average of 53 hours per week. One of the four therapists had the help of one paid assistant for six hours per week; the other therapists did not have assistance. Pupils in six of seven classrooms averaged 7.8 hours of therapy per week (range 3 to 10 hours). The teacher without therapy service taught one moderately handicapped pupil, two severely handicapped pupils and three profoundly handicapped pupils.

The seven teachers averaged more planning time (mean = 4.4 hours, range 2-10 hours) than the therapists (mean = 2.8 hours, range 2-5 hours). Six teachers provided at least three different types of instruction—requesting individual responses in a 1:1 setting (mean 55% of the time, range 25-80%), requesting pupil responses at natural occasions (mean 46% of time, range 10-100%), and requesting pupil responses in group situations (mean 21% of time, range 5-50%). One subject spent 80% of the instructional time in a 1:1 setting and 20% of the time using natural occasions. All four therapists spent at least 90% of their time requesting individual pupil responses during 1:1 instruction.

As a group, the teachers ran programs much more frequently than the therapists. Five of the seven teachers ran programs at least one present session per day and two teachers ran programs four times each week. One therapist saw each pupil three times per week; two, twice a week; and one therapist conducted programs with each pupil once a week.

Two teachers and two therapists generally provided fewer than 10 response opportunities, three teachers and one therapist provided between ten and 20, and two teachers and one therapist more than 20. Four teachers collected data on 95-100% of their programs, two teachers on 85-94% and one teacher on 75-84%. Four teachers collected data every time they conducted an instructional program, and three teachers collected data just about everytime. Teachers differed in the number of trials on which they collected data during their data-based programs. Three teachers reported that data were collected on every trial. Four teachers collected data on either the first or last trial only. Although teachers reported using all of the different data types in their classrooms, five of the seven teachers collected rate data most often.

Two of the four therapists collected data on 95-100% of their instructional programs, while the other two collected data on 50-74% of their programs. One therapist collected data every time the program was run; while the other three collected data about half the time. One therapist collected data on every trial during the program, one therapist collected data on special probe trials, one therapist on three to ten trials per program and one on a variable number of trials depending on the program. None of the therapists used rate data in their programs. Two therapists reported that behavioral counts were the most frequently used data types. The other two therapists reported using percent correct data and time-based data for most of their programs.

All of the subjects graph their data, and all had at least some rules for making decisions. All had rules for moving the pupil to the next step and for when the pupil met the aim for at lease some programs. Eight of 11 did not have rules for deciding

how to modify instructional procedures and seven did not have rules for when to change the instructional strategies.

Training

The first general training session was attended by seven subjects, two advisors, and three of the subjects' instructional aides. Dr. Liberty explained details of participation in the project and discussed prerequisites for use of the decision-rules and different data types. Collection and charting procedures for regular rate and adjusted rate data were discussed and demonstrated by project staff. Session length was approximately one hour, and handouts to subjects attending this session included "Prerequisites on Using the Decision-Rules" and a "Seconds to Decimals" conversion sheet (see Appendix 3).

Following this session, the advisor of the subjects recommended dropping the explanation of data types, collection and charting procedures from training. Therefore, the four subjects who had missed the first general training session and attended make-up sessions did not receive this information. These subjects attended a 40 minute session.

The second general training session was attended by eight subjects, three aides, and the advisor for these subjects. The use of the Handbook of Experimental Procedures and the decision-rules was emphasized for this one hour session. All subjects received the Handbook at the beginning of this session. Subjects were given opportunities to practice drawing minimum 'celeration lines and lines-of-progress following demonstrations by project staff. Verbal explanations of the flow chart of the decision-rules in the Handbook were followed by a practice period in which subjects were asked to determine two types of instructional decisions by applying the rules to charted data. Project staff discussed the "Quick Reference Guide for Acquisition" and how to use it. Procedures for drawing a phase change line and determining a new minimum 'celeration line were demonstrated. Concluding remarks on the requirements for further participation by subjects in this year's study were followed by distribution of the Presentation Response Questionnaire to all subjects. In addition to the Handbook, subjects attending this session received practice sheets on drawing a line-of-progress, and two charts of data for practice in applying the rules. One subject was unable to attend the second general training session and attended a 40 minutes make-up session.

In addition to the group sessions on using the Handbook and the decision-rules, subjects received follow-up assistance from project staff if they elected to try out the procedures in their classroom.

Results

Evaluation of Training

Seven of nine teachers and all four therapists completed a Presentation Response Questionnaire at the conclusion of training. Two teachers completed training but did not return the questionnaire to project staff.

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[1] Two subjects were trained separately, but never completed any questionnaires or used the procedures. They are not included in this group.

A five point Likert Scale was used to measure subjects' ratings of the clarity of information presented during training. Teachers' mean rating for the overall clarity of information presented during training was 4.0 (range 3-5) or "clear" while the therapists' ratings were 5, 3, 3 and 3. In addition to the overall rating, subjects evaluated the information presented on eight specific areas of training (Table 3-3).

Teachers and therapists rated the clarity of some topics differently. Teachers gave a high rating to the information presented on collecting data (mean 4.6, range 4-5) while the therapists rated this topic slightly lower in clarity (4,4,3,3). Therapists gave a lower rating for the information presented on establishing initial instructional formats (4,3,3,3) than did the teachers (mean 4.4, range 4-5). However, therapists rated the presentation on using the Handbook higher (5,5,4,4) than did the teachers (mean 4.1, range 3-5).

Four teachers and two therapists wrote comments regarding training. Two teachers felt that more time should have been spent on setting aims. One teacher and one therapist felt that the training time was too short. Comments by two teachers and one therapist pertained to the usefulness of the decision-rules and the experimental procedures in general, e.g., "My overall impression of the purpose and content of the Instructional Hierarchies Research Project is very positive."

Table 3-3

SUBJECTS' RATINGS OF CLARITY OF INFORMATION PRESENTED DURING TRAINING

Presentation Topic	Teacher Rating (N=7)		Therapist Rating (N=4)	All Subjects (N=11)	
	mean	(range)		mean	(range)
General purpose of the procedures	4.6	(2-5)	5,5,4,4	4.6	(2-5)
Establishing initial instructional formats	4.4	(4-5)*	4,3,3,3	3.9	(3-5)**
Collecting performance data	4.6	(4-5)	4,4,3,3	4.2	(3-5)
Charting performance data	4.7	(4-5)	5,5,5,3	4.6	(3-5)
Drawing patterns	3.9	(3-5)	5,5,4,3	4.0	(3-5)
Using decision-rules	4.3	(3-5)	5,5,4,4	4.4	(3-5)
Types of instructional changes	4.0	(3-5)	4,4,4,3	3.9	(3-5)
Using the Handbook	4.1	(3-5)	5,5,4,4	4.3	(3-5)
Overall	4.0	(3-5)	5,3,3,3	4.0	(3-5)

* N=5 subjects respond to this question
** N=9 subjects respond to this question

Attitude Following Training

Subjects rated their general attitude toward the experimental procedures. The teachers averaged 4.3 (range 4-5), or between "Favorable" and "Very Favorable". Three therapists ratings were 5,4 and ?, and one therapist did not provide a rating.

Subjects also rated how useful the experimental procedures might generally be to teachers. Subjects' average rating was 4.5 (range 4-5) or between "Very Useful" and "Useful".

Teachers rated the overall applicability of the procedures to their own instructional situations as 4.4 (range 4-5) or between "Very Applicable" or "Applicable". Therapists' ratings were 4, 5, 3, and 3 (Table 3-4). Teachers generally found the experimental procedures "Applicable" or "Very Applicable" to their instructional situations. Teachers rated the information on designing initial instructional formats and applying change strategies slightly less applicable (mean 4.4) than the other information presented (mean 4.4, range 4-5). Information on conducting instructional formats, collecting and charting performance data were considered the most applicable (mean 4.7, range 4-5).

The four therapists rated the experimental procedures as slightly less applicable to their own instructional situation than did the teachers, and showed a greater range in responding. The information on designing initial instructional formats was rated the least applicable by therapists (4, 4, 3, 2) while the information on collecting data (5, 4, 4, 3) and conducting instructional programs (4, 4, 4, 4) were rated the highest. In general, there was no clear relationship between subjects' ratings of the clarity of information presented during training and their general attitude towards the procedures. However, subjects rated the usefulness of the procedures to teachers in general (mean 4.5, range 4-5) slightly higher than the applicability of the procedures to their own instructional situation (mean 4.0, range 3-5).

Subjects' instructional practices and educational background were examined to determine if these variables might influence subjects' atttitudes towards the experimental procedures. Three patterns were evident. The three subjects with no Precision Teaching background rated the usefulnes of the procedures in lower (4, 4, 4) than subjects with Precision Teaching (mean 4.6, range 4-5). The same relationship was found between their ratings for overall applicability of the procedures (4, 4, 3 vs mean 4.3, range 3-5), general attitude (3, 4 vs mean 4.4, range 4-5) and individual topics covered in training.

Five of 11 subjects reported that rate data was the data type most frequently used in their classrooms. These subjects rated their general attitude towards the procedures higher ($\bar{X}$ = 4.4, range 4-5) than did the other subjects ($\bar{X}$ = 4.0, range 4-5). A similar pattern was evident in ratings by the five subjects who conduct daily programs and the six subjects who conduct programs less frequently. The former group of subjects gave a much higher rating for their attitude towards the procedures than the latter group of subjects for all topics of training.

In general, subjects with previous experience in Precision Teaching and who apparently used systematic instruction in their educational settings rated their attitude and the applicability of the experimental procedures higher than subjects without this background. There was little, if any, relationship between subjects' ratings of clarity of the topics and their attitude towards the procedures. Teachers rated the experimental procedures more applicable to their instructional setting than did the therapists.

Table 3-4

SUBJECTS' ATTITUDE TOWARD THE EXPERIMENTAL PROCEDURES

Procedure	Teachers (N=7)		Therapists (N=4)	All Subjects (N=11)	
	mean	(range)		mean	(range)
Overall attitude	4.3	(3-5)	3,5,4	4.2	
Usefulness of procedures	4.4	(3-5)	4,4,5,5	4.5	
Applicability					
Overall	4.3	(4-5)	3,4,5,3	4.5	
Designing instructional formats	4.4	(4-5)	4,4,3,2	4.0	(2-5)
Conducting instructional programs	4.7	(4-5)	4,4,4,4	4.1	(3-5)
Collecting performance data	4.7	(4-5)	5,4,4,3	5.4	(3-5)
Charting performance data	4.7	(4-5)	5,4,3,3	4.2	(3-5)
Using decision-rules	4.6	(4-5)	4,4,3,3	4.2	(3-5)
Applying change strategies	4.4	(4-5)	5,4,3,3	4.2	(3-5)

Cost of Training

The total site cost was $386.65. Training costs for the eleven subjects trained as a group in two sessions was $35.15 per subject. These costs include trainer time (2.69 per subject), subject time (25.76 per subject) and Handbook costs ($6.75 each).

Follow-up After Training

One teacher requested additional assistance on designing instructional formats, selecting a data type and selecting aims for all day programs. Follow-up was provided in person by one trainer during a 20 minute session. Two therapists requested more information on selecting a data type and applying the changes to specific programs. One of these therapists also requested information on using the decision rules. For one subject, direct follow-up was provided by one trainer in a 20 minute session, while the other therapist discontinued participation in the study before follow-up could be provided.

The total cost of the two follow-up visits was $14.34.

Evaluation of Handbook

Subjects evaluated the clarity of information presented in The Handbook of Experimental Procedures on the "Handbook Questionnaire." Thirteen questionnaires were distributed and six of seven teachers and two of four therapists returned completed questionnaires (73%). Teachers averaged two hours reviewing the Handbook (range 1.5-3 hours), one therapist spend 30 minutes and one therapist spent two hours.

Subjects rated the clarity of information presented in eight different sections of the Handbook on a Likert scale from 5 ("very clear") to 1 ("confusing"). Subjects generally rated the information as either "4" or "5" (Table 3-5). Teachers and therapists differed in some of their ratings. Teachers rated the sections of the Handbook on drawing lines-of-progress, determining percent correct, performance variability and sharp deceleration in corrects the least clearly presented (mean 4.3, range 3-5), but generally give high ratings for other sections. The two therapists rated the decision-rules for use with rate data and the quick reference guides less clear ("3" and "4") than other sections of the Handbook.

Three teachers provided written comments. Two wrote that the overall content of the Handbook was very good (e.g., "very clear and extremely well written"). One of these subjects, however, indicated that better organization of the materials was needed, due to the number of revisions and additions. The other teacher praised the section on "compliance", but reported that the section on "acquisition" was "hard to follow."

Table 3-5

SUBJECTS' RATINGS OF CLARITY OF INFORMATION PRESENTED IN THE HANDBOOK

Topic	Teachers (N=6)		Therapists (N=2)	All Subjects (N=8)	
	mean	(range)		mean	(range)
Using the Decision Rules	4.7	(4-5)	5,5	4.8	(4-5)
Rules for Rate and the Quick Reference Guide for Rules for Rate	4.6	(4-5)*	3,4	4.3	(3-5)**
Quick Reference Guide for Change Strategies	4.8	(4-5)	4,4	4.6	(4-5)
Lines-of-progress, determining percent correct, performance variability & sharp deceleration in corrects	4.3	(3-5)	5,4	4.4	(3-5)
General considerations in initial instructional formats	4.7	(4-5)	4,4	4.5	(4-5)
Information on Acquisition	4.7	(4-5)	5,4	4.6	(4-5)
Information on Fluency-Building	4.8	(4-5)*	5,4	4.7	(4-5)**
Information on Compliance	4.8	(4-5)	5,4	4.8	(4-5)
Median Rating	4.7		5,4	4.8	

* N=5 subjects responded to this question
** N=7 subjects responded to this question

Adoption of Procedures

All 11 subjects returned a "Trial Period Questionnaire" (100%). Six of the 11 (55%) agreed to do a trial period. All were teachers, serving a total of 47 pupils each year (Table 3-6).

The five subjects who chose not to adopt the procedures ("No" subjects) explained their decisions. Three of the four therapists and two teachers reported that they did not have enough time to use the procedures. One therapist noted, in addition, that the procedures were incompatible with the curriculum.

The "yes" and "no" subjects were compared on a number of variables. Both groups reported administrative support. However, five of six "yes" subjects reported "peer support" (other teachers in their school using the procedures) while only one of the seven "no" subjects were aware of any other teacher or therapist using the procedures. "Yes" subjects averaged fewer pupils per day than "no" subjects (mean 7.8 versus mean 10.4), more planning time (mean 4.8 hours vs. mean 2.6 hours) and more assistance in the classroom. Five of the six "yes" subjects reported previous training in Precision Teaching, while only three of the five "no" subjects had had such training. Some differences in evaluation procedures were found between the two groups of subjects. In general, "yes" subjects collect data on a higher percentage of their instructional programs (4 of 6 "yes" subjects collect data on 95-100% of their programs versus 2 of 5 "no" subjects), on a more consistent basis (all six "yes" subjects collect data almost every trial vs. 2 of 5 "no" subjects) and use rate data more often (5 of 6 "yes" report rate data as the most frequently used data type versus 1 of 5 "no" subjects). There was no difference between the "yes" and "no" subjects in their rating of the Handbook or the training. They did differ, however, in their attitude toward the experimental procedures following training; "yes" subjects rated the procedures as more applicable than "no" subjects (mean 4.3 versus mean 3.8). Both groups gave similar rating in other areas, including the "usefulness" of the procedures.

Table 3-6
PUPILS SERVED BY SUBJECTS USING PROCEDURES

Subject	No. Pupils	Age Range	Handicapping Conditions
5402	15	1-5	mild, moderate, severe, profound
5403	7	5-10	moderate, severe, profound
5404	5	8-11	moderate, severe, profound
5405	6	6-11	moderate, severe, profound
5413	7	13-17	moderate, severe, profound
5414	7	14-17	severe, profound

Additional Follow-up

Twenty-five follow-up contacts were made to six subjects during their application of procedures: 13 visits and 12 phone conversations. Topics covered during the visits included: review of minimum 'celeration procedures, setting aims, selecting program targets and establishing initial instructional formats, fluency building strategies and aim setting, data collection, noncompliance, and review of their pupils' performance data on several programs. The cost of the 25 follow-up contacts was $250.77.

Application of Procedures

The six teachers applied the procedures with 17 pupils in 53 programs for a total of 71 weeks (36% of the pupils served by these teachers). One teacher reported three times, two teachers each reported twice, and three teachers each completed one Procedures Questionnaire.

Five of the teachers reported that they preferred collecting rate data: these teachers applied the procedures in programs in which they collected rate data exclusively. The teacher who had preferred to use percentage correct data also collected rate data on the one experimental program. All of the teachers used the rule procedure with minimum celeration lines.

Prior to the application of the procedures, five of the six subjects had rated the Handbook. Of these subjects, three rated the Handbook a median of 5.0. Two of these subjects gave the Handbook a median rating of 4.0 during application, while one continued to rate the handbook at 5.0. Two subjects rated the Handbook at 4.0 overall, both before and during the application (Figure 3-1). The subject who did not rate the Handbook prior to application initially rated the Handbook at 4.0, then increased the median rating to 5.0 on the second reporting period (Figure 3-1). Ratings for each topic were generally lower during the application than prior to the actual use of the Handbook (Table 3-7).

Table 3-7

SUBJECTS' RATINGS OF THE USEFULNESS

OF THE HANDBOOK DURING APPLICAITON OF THE PROCEDURES

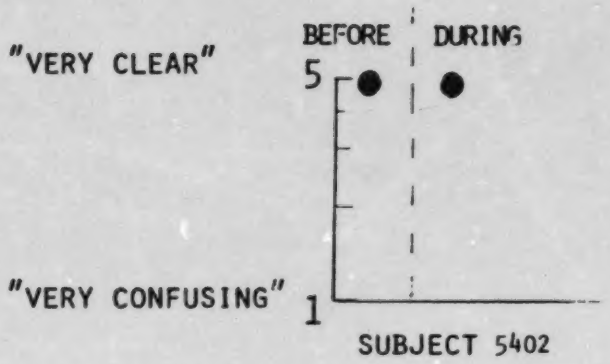
	TOPIC	RATING	
		mean	range
1.	How to Make an Instructional Decision	4.50	4-5
2.	Quick Reference Guides for Change Strategies	4.50	4-5
3.	Drawing Lines of Progress	3.50	2-5
4.	Determining Percent Correct	3.33	1-5
5.	Determining Performance Variability	3.67	3-5
6.	Sharp Deceleration in Corrects	4.67	4-5
7.	General Considerations for Instructional Formats	4.50	4-5
8.	Acquisition	4.17	4-5
9.	Fluency-Building	4.17	4-5
10.	Compliance	4.67	4-5
11.	Overall	4.25	

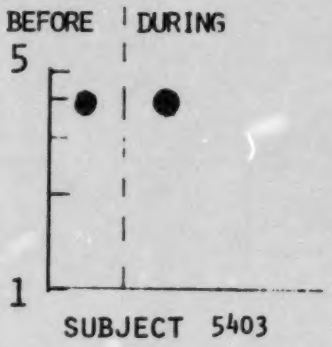
Prior to the use of the experimental rules, the six subjects reported planning for a median of four hours per week (range 2-10). During the application of procedures, the median was 1 hour per week (range 5-6). All of the teachers spent less time planning than before, although five teachers estimated that they spent more time. Figure 3-2 shows the change in reported planning time.

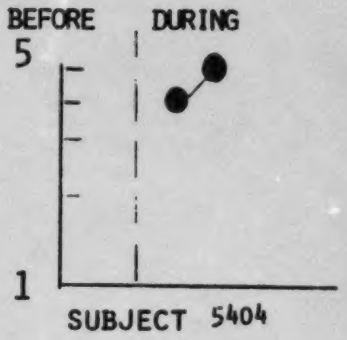
Two of the six subjects rated their attitude to the procedures as "4" prior to application; during the use of the procedures, their ratings increased to "5" (Figure 3-3). Four subjects initially rated their attitude at "4", and only one of these subjects increased the attitude rating to "5" during application of the procedures.

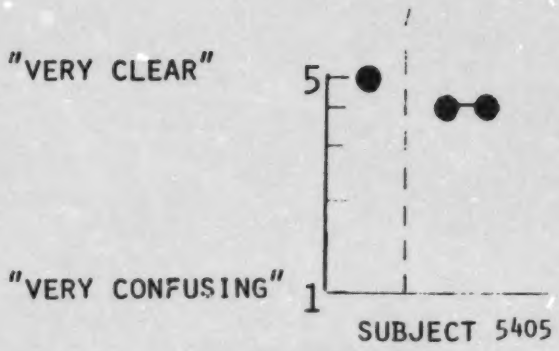
FIGURE 3-1

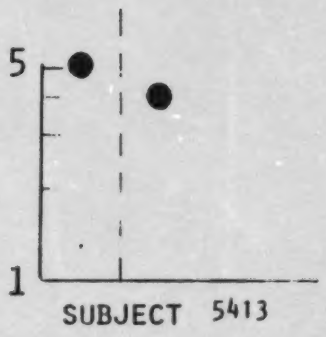
HANDBOOK RATINGS BEFORE AND DURING APPLICATION OF DECISION RULES











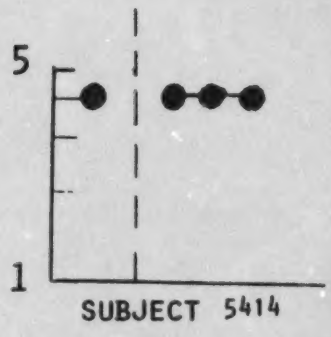
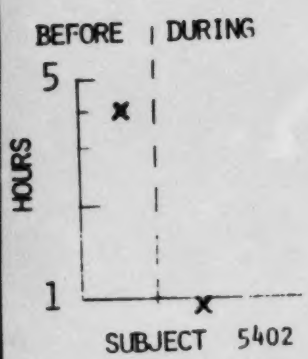
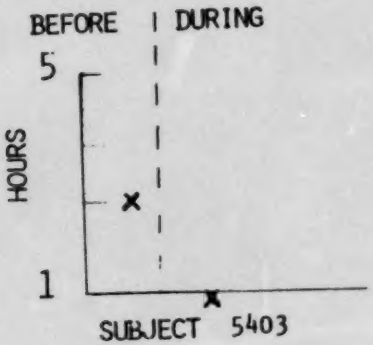
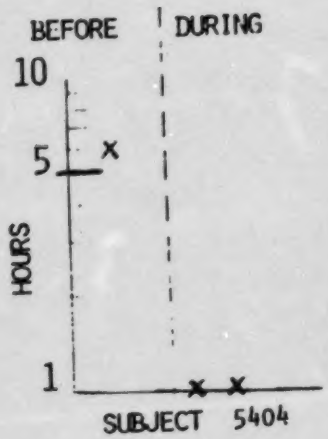


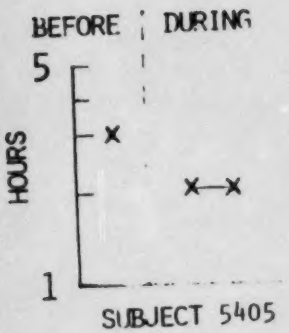
FIGURE 3-2

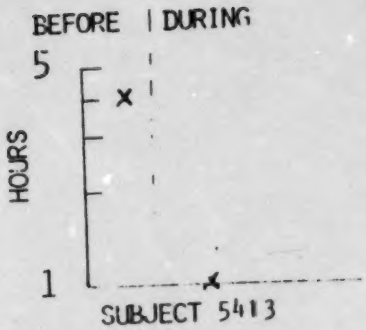
HOURS PLANNING BEFORE AND DURING APPLICATION OF DECISION RULES

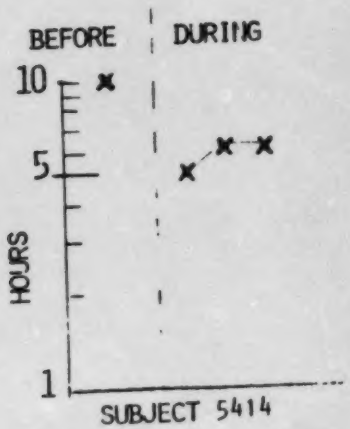












Insert Figure 3-3 Here

Impact on Pupil Performance

The six subjects applied the experimental procedures in a total of 53 programs involving 17 pupils. Each subject shared some pupil performance data, on a variety of target behaviors (Table 3-8).

Subject 5402 applied the procedures to one program for one pupil for a total of 56 calendar days and 18 data days (Table 3-9). During this time, the pupil did not progress to a new curricular step (step ahead). The teacher made one intervention, but did not follow the suggested strategy and changed late. The intervention was not successful, as would be predicted (Table 3-10). Subject 5402 estimated that the use of the experimental procedures made no difference to this pupil's progress.

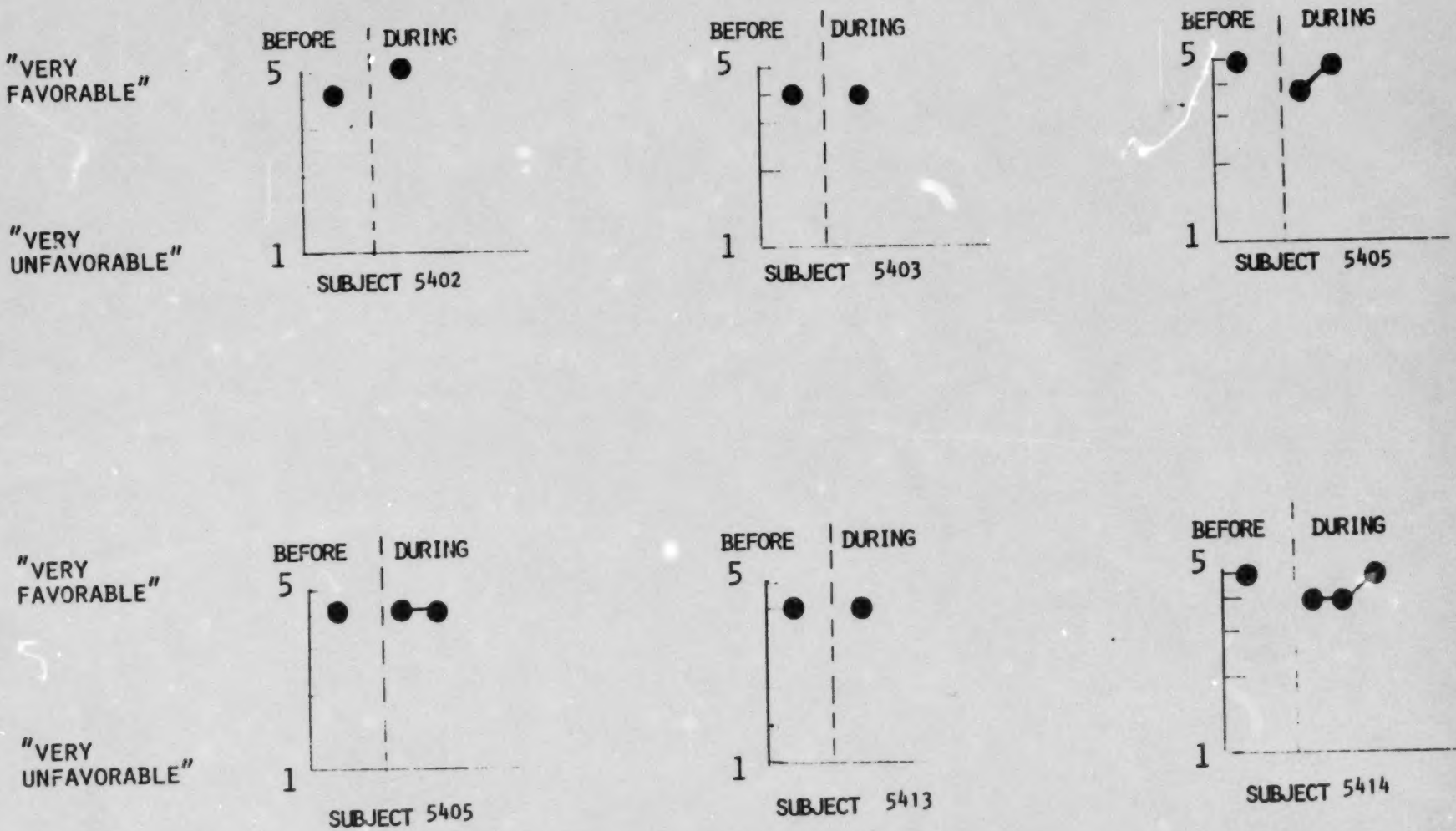
Subject 5403 shared data showing the application of the experimental procedures in three programs for one pupil. The charted pupil performance data showed no evidence that this subject drew new minimum 'celeration lines following the program changes; or evidence that lines-of-progress were drawn in order to use the flow chart to determine recommended strategies. Data for three of the programs included pupil performance prior to the application of procedures as well as during application. Prior to the use of the procedures, the pupil had moved ahead in the curriculum once in 11 data days in a sorting program, and not at all in a 25 data day string beads program or a 10 day object identification program (Table 3-10). No other interventions were made in these programs. During the use of the procedures, the subject stepped ahead a total of six times, and a total of eight other interventions were made (Table 3-10). When the subject followed the rules, these interventions were successful; when the rules were not followed, the interventions were not successful. The rules correctly predicted the outcomes of the interventions 88% of the time (Table 3-11).

Subject 5404 applied the procedures in four programs with two pupils. These two subjects fell below minimum 'celerations lines 30 times during the 237 days of data collected. Subject 5404 changed on time nine times, changed 2-4 days late on 20 times, and did not change one time. After changing instructional procedures, 5404 sometimes followed the procedures and drew new minimum 'celeration lines, and sometimes continued using the line from the previous phase (not according to the procedures). In the 12 strategy interventions that could be analyzed, the subject used the suggested strategy six times (Table 3-9). Overall, 58% of the interventions were successful, and the subject used the suggested interventions 55% of the time (Table 3-11). The rules accurately predicted the outcomes of the interventions in 82% of the cases (Table 3-11). Subject 5404 reported that the procedures accelerated pupil progress in some programs and decelerated progress in others. There are no data to indicate pupil progress prior to the use of the procedures.

Subject 5405 applied the procedures in 12 programs with five pupils. These five subjects fell below minimum 'celeration lines 27 times during the 540 days of data collected. Subject 5405 changed on time 16 times, eight times late and did not change strategies on two occasions. Following the changes, 5405 did not always draw new minimum 'celeration lines as recommended by the procedures; if a new line were drawn, however, it was drawn from an incorrect starting point. There was no evidence that the subject drew lines-of-progress on the charted data in order to use the flow chart. Of the 29 strategy interventions made by this subject, 27 were analyzable

FIGURE 3-3

ATTITUDE TOWARD PROCEDURES BEFORE AND DURING APPLICATION OF DECISION RULES



(Table 3-9). Of these, 15 (56%) were successful. The subject used the suggested strategies 56% of the time, and the rules correctly predicted the outcomes of the interventions used 92% of the time (Table 3-11). Subject 5405 estimated that the use of the procedures accelerated pupil progress, although there were no data to indicate progress prior to application of the procedures.

Subject 5413 applied the procedures in three programs for one pupil. This subject used the procedures correctly, and collected a total of 62 days of data in a total of 142 calendar days (Table 3-9). During this time, the pupil moved ahead in the curriculum a total of 8 times. There were no other changes in curriculum level or instructional strategies, so the use of the rule procedures cannot be evaluated. Subject 5413 estimated that the procedures made no difference in pupil progress. There were no data to indicate pupil progress prior to application of the procedures.

Subject 5414 applied the procedures in 11 programs for three pupils. This subject also taught the aide to utilize the procedures in 14 other programs for three other pupils. Both Subject 5414 and the aide applied the procedures correctly. One of 5414's pupils' data included 192 days of data collected in three programs. During this time, 5414 made a total of 24 interventions for compliance problems, only two of which were successful (8%). (Because of the unique nature and difficulties with compliance problems, the results for this pupil are presented separately in Table 3-9). For the other two pupils, 14 of the 23 usable interventions were successful in changing pupil progress (61%). The teacher followed the suggested interventions 41% of the time, and the rules correctly predicted the outcomes in 82% of the cases (Table 3-11). Data showing pupil progress prior to the use of the procedures was made available (Table 3-10). Generally, the pupils moved through the curriculum faster and the teacher made more interventions than before the use of the rule procedure. The teachers rate of successful interventions was higher when the suggested strategies were followed (Table 3-10). Subject 5414 estimated that the use of the procedures accelerated pupil progress.

Subject 5414's instructional aide was taught the procedures by 5414. The aide applied the procedures in 14 programs for three pupils over a total of 811 days of data (Table 3-7). Most of the changes were step aheads, as the pupils moved through the curriculum (Table 3-9). Of the 10 usable interventions, nine were successful. The aide followed the recommended strategy changes 90% of the time, and the rules were 80% successful in predicting the outcomes of those interventions (Table 3-11). In most cases, pupils progressed thrugh the curriculum faster (fewer days in each curricular step) and intervention strategies were more successful during the application of the procedures as compared to performance prior to application (Table 3-10).

Summary. As a group, these subject provided substantial amounts of pupil performance data collected during the application of the rule procedures (Table 3-9). However, except for the aide's data, the percentage of successful interventions was less than 61%; and the average, including the aide's 90% was only 59%. Further analysis shows, however, that subjects only chose to use the suggested interventions about 55% of the time (Table 3-11). In other instances, teachers used their own ideas about what interventions would be successful. The use of a suggested strategy is a prediction that the pupil's progress will fail to accelerate. In the case of these subjects, predictions based on the rules proved accurate 85% of the time (Table 3-12). There were 40 instances in which the subjects followed the rules, and progress was accelerated in 35 of them (Table 3-12). The subjects did not follow the suggested strategies in 33 cases, and, in 27 cases, the pupil's progress failed to accelerate (Table 3-12).

Data on 18 programs showed pupil progress both before and during application of the experimental rule procedures. One measure of progress is how often the pupil moves to the next curricular step. Each program was designed by the teacher, and the number of curricular steps, and the length of time it takes to go through those steps is partially determined by the task analysis as well as by the effectiveness of teacher programming. In seven programs, pupils moved ahead faster (shorter number of days to reach aim) during the period when the rules were applied (Table 3-10) than they did when the rules were not in effect. On the other hand, pupils in six programs moved ahead faster prior to rule application. Thus, the rules, as applied by these subjects, may not have affected pupil progress, given that recommended interventions were generally made 55% of the time.

Teachers generally did make more interventions during the rule application (Table 3-10) than before the rule application, and the percentage of successful interventions was generally higher, especially when the teacher used one of the recommended strategies.

Cost Analysis

The total costs for training 11 subjects at this site are shown in Table 3-13. Of the 11 trained subjects, six actually utilized the procedures in programs for 17 pupils over a total of 71 weeks. If all site costs are included, these figures result in an average per pupil cost of $38.34 for those pupils for whom the experimental procedures were applied, or approximately $9.18 per week of application for each teacher.

If costs are separated to include only those costs incurred in the training subjects who acutally used the procedures, these figures are reduced to a median cost of $15.15 per pupil and $4.78 per week (Table 3-14). For subjects who applied the procedures, the cost per program per week averaged $.38. Figures for the subjects vary considerably.

Table 3-8

TARGETED MOVEMENT CYCLES IN PUPIL PERFORMANCE DATA

Age Range of Pupils	Movement Cycles*
1-6	touches table
6-12	identifies objects; strings beads; sorts objects; names currency; names numbers; reads words orally; says sight words; writes digits to answer add facts; points to named currency; maintains eye contace; reach and touch; folds, staples and stuffs; follow directions; answers questions about reading; reads sentence and matches to picture.
8-17	points to named colors; snaps pants; says phone number; says name and address.
12-22	writes name, address and phone number; files alphabetically; says time of day; assembles booklets; touches named clothing; walks balance beam; sorts objects; copies block design; uses communication board; types letters; folds, staples and stuffs; collates pages; touches cards "eat" "milk"; says letters; articulates sounds; says emergency words; identifies money; speaks intelligibly; uses language cards; writes name.

* Movement cycles are given generally as described by subjects; most subjects counted both correct and error responses although that distinction is not made above

Table 3-9

ANALYSIS OF PUPIL PERFORMANCE DATA

Application of the Minimum 'Celeration Procedures

Subject	Pupils	Programs	Calendar Days	Data Days	Phases	Step Aheads	Inter-ventions	Usable	#Success Inter.	%Success Interv.	Subject's Estimate of Impact of Procedures
5402	1	1	56	18	2	0	1	1	0	0%	no difference
5403	1	3	267	138	17	6	8	6	2	33%	no difference in some accelerated some
5404	2	4	387	237	26	3	20	12	7	58%	both accelerated and decelerated
5405	5	12	1220	540	88	45	29	27	15	56%	accelerated
5413	1	3	142	62	10	8	0	0	-	-	no difference
5414*	2	8	1136	513	97	41	48	23	14	61%	accelerated
5414 aide	3	14	1752	811	96	66	20	10	9	90%	accelerated
TOTAL	15	45	4960	2319	336	169	126	79	47	59%	

* In addition, 192 days of data were collected over 504 calendar days in three programs for one other pupil. In 35 phases, the pupil met aim and moved to the next curricular step (step ahead) 7 times. Twenty-four interventions were made for compliance problems; of the 22 usuable interventions, 2 (9%) were effective.

Table 3-10

INDIVIDUAL PUPIL PROGRESS BEFORE AND DURING APPLICATION OF EXPERIMENTAL PROCEDURES

			Before Use of the Rules					During Use of Rules					
Subject	Pupil No.	Behavior	Data Days	Step Aheads	Av. Days To Step Ahead	Inter-ventions	% Success Interven-tions	Data Days	Step Aheads	Av. Days To Step Ahead	Inter-vent-ions	% Success Interven-ions	% Follow Rules
5403	1	identify obj.	10	0	?	0	?	43	1	43	4	0%	0%
5403	1	string beads	25	0	?	0	?	47	3	14	2	100%	100%
5403	1	sorts obj.	11	1	11	0	?	48	2	24	2	100%	100%
5414	1	assem-bles	21	1	21	2	100%	72	10	8	2	100%	100%
5414	1	touch clothing	20	0	?	3	0%	51	3	17	6	66%	33%
5414	1	walks bal. beam	16	3	5	0	?	65	7	9	5	75%	75%
5414	1	sorts	52	3	17	8	33%	65	4	16	6	33%	33%
5414	2	copies block design	10	0	?	1	100%	89	13	7	7	80%	80%
5[illegible]14	2	pts to lang. board	29	0	?	2	0%	81	3	27	6	100%	50%
5414	2	types letters	20	1	10	0	?	35	1	35	2	0%	0%
5414 aide	1	ident. money	45	2	22	1	100%	68	8	8	3	100%	100%
5414 aide	1	says letters	56	4	14	1	100%	72	6	12	0	?	?
5414 aide	1	says emerg. signs	49	2	24	1	0%	51	4	13	0	?	?
5414 aide	2	says emerg. signs	50	3	17	2	50%	47	4	12	2	50%	50%
5414 aide	2	says letters	13	2	6	1	?	69	3	23	1	100%	100%
5414 aide	2	files alphabet-ically	50	6	8	2	50%	53	5	11	2	100%	100%
5414 aide	3	pts. to lang. card	32	6	5	0	?	64	7	9	0	?	?
5414 [illegible]	3	ident. money	42	2	21	2	50%	60	3	20	2	100%	100%

Table 3-11

UTILIZATION OF SUGGESTED STRATEGIES

Subject	# Interventions	# Usable	# Successful	% Successful	# Using Suggested Strategy	% Using Suggested Strategy	Predictability of the Rules
5402	1	1	0	0%	0	0%	100%
5403	8	6	2	33%	3	50%	88%
5404	20	12	7	58%	6	55%	82%
5405	29	27	15	56%	15	56%	92%
5413	0	-	-	-	-	-	-
5414*	48	23	14	61%	7	41%	82%
5414 aide	20	10	9	90%	9	90%	80%
TOTALS	126	79	47	59%	40	55%	85%

* of 24 interventions made for another pupil, all were for compliance problems. Of the 24, 22 were analyzable, and 16 were in accord with the suggested change strategies; 1 of these was successful. The compliance rule accurately predicted the results of the interventions 27%.

Table 3-12

ACCURACY OF RULES FOR INTERVENTION CHANGES

	Pupil Progress Actually Accelerated	Pupis Progress Did Not Actually Accelerate
Change made in accord with a rule (Prediction that progress will be accelerated)	48%* (N=35)	7% (N=5)
Change made not in accord with rule (Prediction that progress will not be accelerated)	8% (N=6)	37%* (N=27)

* Concurrence of prediction and actual results indicates rule accuracy: total 62/73 85%

Table 3-13

COST SUMMARY

ALL COSTS

No. Subjects Trained	:	11
Total Handbook Costs	:	$ 386.65
Total Follow-up Cost	:	$ 265.11
TOTAL SITE COST	:	$ 651.76
Av. Per Subject Cost	:	$ 59.25
Av. Per Pupil Cost*	:	$ 38.34
Av. Per Week Cost**	:	$ 9.18

* Includes N=17 pupils whose teachers applied the procedures in instructional programs
** Includes N=71 weeks during which teachers applied procedures

Table 3-14

COSTS FOR SUBJECTS APPLYING PROCEDURES

Application of procedures				All Costs			Cost Analysis			
Subject	Weeks	Pupils	Programs	Training	Follow-up	Total	Per Pupil	Per Program	Per Week	Per Program/Week
5402	8	1	1	$ 35.15	$ 40.70	$ 75.85	$ 75.85	$ 75.85	$ 9.48	$ 9.48
5403	6	1	3	$ 35.15	$ 60.49	$ 95.04	$ 95.64	$ 31.88	$ 15.84	$ 5.31
5404	16	3	6	$ 35.15	$ 29.08	$ 64.23	$ 21.41	$ 10.71	$ 4.01	$ .70
5405	16	5	12	$ 35.15	$ 37.48	$ 72.63	$ 14.53	$ 6.05	$ 4.54	$ .38
5413	6	1	4	$ 35.15	$ 25.24	$ 60.39	$ 60.39	$ 15.10	$ 10.07	$ 2.52
5414	19	6	26	$ 35.15	$ 55.72	$ 90.87	$ 15.15	$ 3.50	$ 4.78	$ .18
TOTAL	71	17	53	$ 210.90	$ 248.71	$ 459.61				
MEDIANS						$ 74.24	$ 15.15	$ 6.05	$ 4.78	$ .38

SITE 4

Introduction

The cooperative arrangement between the Seattle Public Schools and the Instructional Hierarchies Research Project, initiated during the fourth project year, was continued during the fifth project year following consultations with Dr. Bill Tilley, Director of Special Services.

Seattle is a large urban city with a population of 497,300 as of April 1, 1979. Mandatory busing for racial desegregation is presently in effect. There are 112 schools within the Seattle Public School system, 65 schools serve both handicapped and nonhandicapped students and three schools serve handicapped students exclusively. There are 47,662 nonhandicapped students enrolled in the district and 2,513 handicapped students.

Three schools, Green Lake Elementary and Lowell Elementary (serving handicapped and nonhandicapped pupils preschool - Grade 5), and Wilson Pacific High School (serving handicapped pupils aged 13-22) and Lowell Elementary (serving handicapped and nonhandicapped pupils, preschool - Grade 6) were selected for participation because the majority of classrooms serving severely, profoundly and/or multiply handicapped pupils in the district were located in these schools. Meetings of approximately 30 minutes were held separately with each principal. During each meeting, members of the research staff presented an overview of the purpose of the project and provided copies of the consent form (Appendix 4) and the Background Questionnaire. Each prospective subject met individually or in a small group with interested teachers, some of whom were recommended by th principal. Twelve teachers consented to participate. Subjects were trained both in small groups and in individual sessions.

Method

Subjects

All 12 of the consenting teachers were experienced teachers (mean = 9.6 years teaching, range 3-22 years). The average number of years teaching special education was 8.25, ranging from 3-22 years. Eight of the 12 teachers reported formal training in Precision Teaching.

The 12 teachers served 215 pupils with the following "labels": learning disabled (8); mildly handicapped (14); moderately handicapped (68); severely handicapped (76); profoundly handicapped (32); multiply handicapped (11), and orthopedically handicapped (6). Three of the teachers served a total of 135 pupils: one served 36 pupils in a team teaching situation and two served 50 and 49 pupils respectively in resource rooms. The average class size of the other nine subjects was 8.4 pupils (range 5-16). Two teachers served a total of 41 preschool pupils (aged 2-6), five teachers served 39 elementary pupils (aged 6-12), one teacher served five mixed preschool and elementary pupils (aged 3-11) and four teachers served 127 high school pupils (aged 12-22).

Each of the 12 teachers had some assistance in the classroom. There were a total of 23 paid assistants, five volunteers, 16 student teachers and nine other people, for 644 hours per week. The subject with the most assistance had a total of six people helping for 121 hours per week, while the subject who had the least had two people

assisting for eight hours per week. The average amount of assistance available to each of the 12 teachers 12 hours per week. Pupils in 11 of the 12 classooms received an average of 15 hours of therapy assistance weekly (range 1-40 hours).

All of the teachers provided both 1:1 and group settings for instructional responding. Three teachers spent the majority of instruction in 1:1 settings and two spent the majority of instructional time in group settings. The other teachers divide their time between those two settings, and using natural occasions to teach new responses. Three teachers also use unison responding a small portion of the time. Ten of the teachers conduct instructional programs at least once per day, while two conduct programs three times per week. Six teachers conducted at least 10 trials per program, while three provided five-nine trials, and three provided fewer.

All 12 teachers collect some data on student performance. Three teachers collect data on 95-100% of the programs, four teachers collect data on 85-94% of the programs, one teacher on 75-84%, two teachers on 25-49% and two teachers collect data on 10-24% of the programs. Six teachers collect data every time an instructional program is conducted, and six teachers collect data almost every time a targeted program is conducted. Six subjects collected data on every trial of their data-based programs. Two subjects collected data on "probe" trials only, one on the first trial only, one on a random number of trials, one on a consistent number of trials as stated in the program and one teacher collects data on every trial on a new program and on probe trials in established programs. The most frequently used data type was accuracy data, although use of all other data types was reported.

Three teachers graphed their data. All have definite rules in at least some of the programs for deciding when to step ahead and when the pupil has met aim. Seven teachers reported having decision-rules for at least some of their programs to determine when to change instructional procedures rather than the program. Only one subject reported specific rules for deciding how to modify instructional procedures.

Training

The training sessions were scheduled at the subject's convenience, either before school, during the subject's regularly scheduled planning time, or lunch time. There were generally four or five sessions each lasting about 30 minutes. Six subjects were trained individually and six subjects were trained in small groups of two and four teachers. Total training time ranged from 1.92 hours to 3.38 hours (Table 4-1).

The content of the training sessions was identical for all subjects. Prerequisites for use of the data decision-rules and a general introduction to data and data collection were covered during the first training session. Subjects received a handout covering these topics, prepared for the October AAESPH conference in Chicago. The second and sometimes third training session covered data collection and charting of regular rate, adjusted rate, latency, and duration (trial and session) data. The subjects practiced collecting and charting each type of data. At the next session, subjects were taught how to set a minimum 'celeration line, draw lines-of-progress and apply the decision rules. The final training session covered using the Handbook, and acquisition, fluency-building and compliance strategies. At the end of this session subjects were asked to complete a Presentation Questionnaire and given the Handbook of Experimental Procedures.

Table 4-1

Length and Cost of Training

Subject	Length of Training	Cost		
1:1 Training				
5501	2.5 hours	$62.40		
5502	3.01 hours	$73.49		
5503	3.38 hours	$81.07		
5504	3.08 hours	$75.02		
5507	1.92 hours	$49.81		
5508	2.25 hours	$56.98		
Median	2.75 hours	$67.95	Total =	$398.77
1:2 Training				
5513	2.67 hours	$63.16		
5514	2.67 hours	$63.16	Total =	$126.32
1:4 Training*				
5509	2.34 hours *	$43.91		
5510	2.34 hours	$41.47		
5511	2.34 hours *	$45.42		
5512	2.34 hours	$41.47	Total =	$172.27
			TOTAL	$697.36

* includes individual make-up sesssion

Follow-up After Training

Two subjects requested some additional information following training. This information was provided in three phone conversations for a total cost of $2.45 and a visit of $4.32. Total cost, excluding mileage, was $6.14.

Evaluation of Handbook

Each of the 12 teachers received a copy of the Handbook of Experimental Procedures, and two weeks later each received the Handbook Questionnaire. Eleven subjects completed the questionnaire while one subject reported insufficient time to read the Handbook. Teachers spent an average of two hours and five minutes reviewing the Handbook (range 10 minutes to 5½ hours). They rated the section on compliance as the clearest (4.5) and the information on rules for rate and the Quick Reference Guides as the least clear (Table 4-2), and the median rating was 4.2, as before application.

Ten teachers wrote comments on the Handbook. They suggested a Table of Contents and additional examples of programs for low-functioning pupils be added.

Table 4-2

SUBJECTS' RATING OF CLARITY OF INFORMATION PRESENTED IN THE HANDBOOK OF EXPERIMENTAL PROCEDURES

Content Area	Ratings (N=17) mean (range)
Using data decision-rules	3.8 (2-5)
Rules for rate and quick reference guide for rules for rate	3.6 (2-5)
Quick reference guides for change strategies	4.3 (2-5)
Drawing lines-of-progress	3.8 (2-5)
General considerations for instructional formats	4.2 (2-5)
Acquisition	4.2 (2-5)
Fluency-building	4.5 (2-5)
Compliance	4.2 (2-5)
Median Rating	4.2 (2-5)

Teachers (N=11)

Adoption of Procedures. Although all 12 subjects agreed to apply the procedures to some programs, only 11 returned Procedures Questionnaires indicating that they actually applied the procedures. These subjects served a total of 133 pupils per year (Table 4-3).

Table 4-3

APPLICATION OF PROCEDURES

Subject	Pupils	Handicapping Conditions	Age Range	Application of Procedures		
				Pupils	Programs	Weeks
5501	34	learning, disabled, mild, moderate, severe, profound	3-6	1	1	12
5502	6	moderate, severe	6-10	6	6	19
5503	9	moderate	8-12	2	5	5
5504	6	profound	7-11	1	1	12
5507	6	severe, profound	3-12	2	4	6
5508	5	profound	12-21	1	1	6
5510	15	severe	13-21	1	1	5
5511	13	severe	13-21	1	1	5
5512	27	severe, profound	13-21	2	2	5
5513	6	severe, profound	7-12	2	4	4
5514	6	severe, profound	9-12	3	5	6
TOTAL	133			22	31	97

Additional Follow-up

Sixteen follow-up requests were received. The topics covered during the follow-up visits included: charting (6 subjects); data collection (2 subjects); drawing minimum 'celeration lines (2 subjects); setting aims (1 subject); drawing lines-of-progress (1 subject) and interpreting pupil data (1 subject). The cost of the 15 follow-up visits was $115.72, (see Table 4-10 for per subject costs).

Application of Procedures

The 11 teachers applied the procedures with 22 pupils in 31 programs for a total of 97 weeks. The 22 pupils represent about 17% of the pupils served by these teachers (Table 4-3). One teacher reported three times on the application of the procedures, four teachers reported twice, and six teachers reported once each.

Prior to application of the experimental procedures, six teachers reported that they collected percent correct data most often, one collected counts of trials, one collected counts of behavior and two collected rate data most often. However, during the experimental procedures, time based data (rate, duration or latency) were collected in all but one of the programs. All of the teachers used the rule procedure with minimum 'celeration lines.

Many of the subjects rated the Handbook content lower during the application of the procedures than prior to its use (Figure 4-1). In general, the technical content areas tended to be rated as before, while the descriptive sections (e.g., "acquisition") dropped in ratings (Table 4-4).

INSERT FIGURE 4-1 HERE

FIGURE 4-1

HANDBOOK RATINGS BEFORE AND DURING APPLICATION OF DECISION RULES

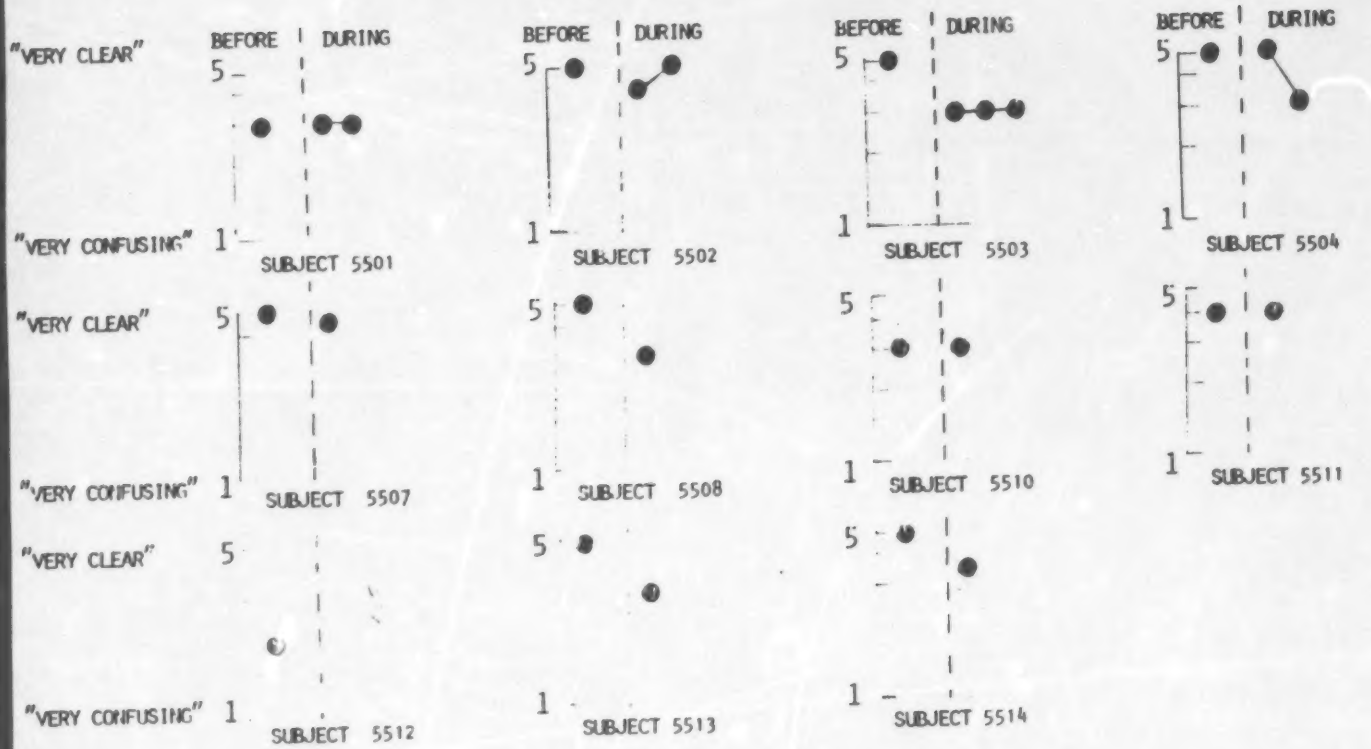


Table 4-4

Rating of Handbook Content During Application of Procedures

Content Area	Ranking Before Use N=11	Ranking During Application* N=10
How to make an instructional decision	3.82	4.6
Rules and quick reference guides	3.64	4.6
Technical procedures (draw minimum 'celeration lines; draw lines of progress; determine hihg variability; determine percent correct)	3.8	3.6
Designing instructional formats	4.2	3.8
Acquisition	4.2	3.2
Fluency Building	4.2	3.7
Compliance	4.5	4.3
Overall	4.2	3.9

* Includes only reports during first Procedures Quesitonnaire; for changes in ratings over the application period, see Figure 4-1.

Prior to the application of the experimental procedures, the 11 subjects reported spending a median of four hours per week planning (range 2-5). During the application of procedures, the median was 1 hour per week (range .5-2). All of the teachers spent less time planning instruction than before, although five of them estimated that they spent more time, and four estimated that they spent the same amount of time planning as previously. Figure 4-2 shows the change in reported planning time.

INSERT FIGURE 4-2 HERE

The attitude of four of the teachers toward the procedures dropped during actual application (Figure 4-3), while the attitude of seven teachers remained the same. The change in attitude is reflected in the means shown in Table 4-5, and cut across all aspects of the procedures except collecting data.

FIGURE 4-2

HOURS PLANNING BEFORE AND DURING APPLICATION OF DECISION RULES

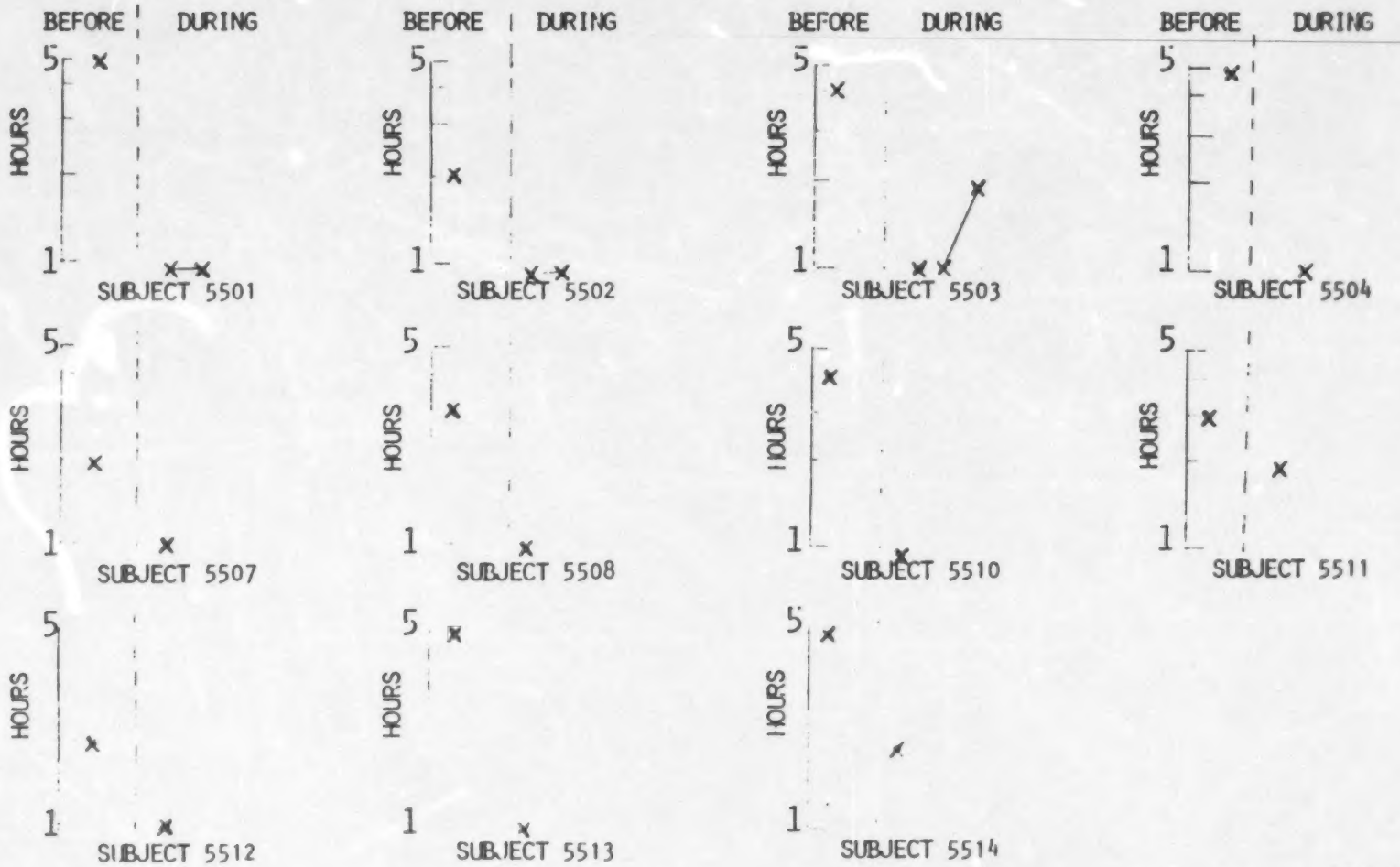


Table 4-5

Average Rating of Attitudes Toward Procedures

Procedures	Attitude Prior To Application	Attitude During Application
Establish instructional programs	4.75	4.1
Collect data on pupil performance	4.8	4.8
Chart pupil data	4.5	3.7
Use experimental rules	4.8	3.9
Use suggested strategies	4.75	3.8
Overall	4.6	4.2

Impact on Pupil Performance

Five subjects shared data of eight pupils in 12 programs on a variety of behaviors (Table 4-6). Six of the 11 subjects indicated that they thought that the application of the experimental procedures had accelerated pupil progress. Four of these teachers provided some pupil performance data (Table 4-7). Subject 5504 made two changes in the one experimental program conducted, and both of these were step aheads. Thus, it is impossible to evaluate the impact of the rules in this particular program. Subject 5502 made only one intervention, and that was not in accord with the rules, and the intervention did not improve pupil performance (Table 4-7 and Table 4-8). However, this subject applied the procedures in four other programs not submitted. Subjects 5503 and 5508 each had three usable interventions in the data submitted to the project, and the majority of these interventions were successful. Thus, of the four subjects who estimated that pupil performance was accelerated, and whom submitted pupil performance data, two show some level of successful intervention during the use of the procedures. Since data indicating pupil progress prior to application of the procedures are not available, no comparison with previous progress can be made. All of these subjects plan on using the procedures in the future.

Four of the 11 subjects indicated that the procedures made no difference to pupil performance. One of these subjects submitted program data (Table 4-7). Subject 5512 collected 41 days of data on two programs with two pupils. During this time no changes or interventions of any kind were made. Since no changes or interventions were made it is difficult to estimate the impact of the rules on the pupil's performance. All of these subjects plan on using the procedures in the future.

Subject 5501 reported twice, at first indicating that pupil progress accelerated during the use of the procedures, and then that the procedures did not affect pupil progress. This subject did not provide any pupil performance data, but plans on continuing to use the procedures.

Cost Analysis

The total costs for training 12 subjects at this site are shown in Table 4-9. Of the 12 subjects, 11 actually utilized the procedures in programs for 22 pupils over a total of 97 weeks. If all site costs are included, these figures result in an average per pupil cost of $37.26 for those pupils for whom the experimental procedures were applied, or approximately $8.45 per week of application per teacher.

If costs are separated to iclude only those costs incurred in training subjects who actually used the procedures, these figures are reduced to a median cost of $23.45 per pupil and $6.61 per week per teacher (Table 4-10). If costs are calculated per program per week, the median cost is $4.69.

Table 4-6

Age Range	Movement Cycles
3-4	holds head up
6-12	spells words, pulls loop tight (shoes), traces upper case letters, reads words orally, points to letters of name, touches object
13-21	assembles sifters, assembes gas valves

Table 4-7

ANALYSIS OF PUPIL PERFORMANCE DATA

Application of the Minimum 'Celeration Procedure

Subject	Pupils	Programs	Calendar Days	Data Days	Phases	Step Aheads	Inter-ventions	Usable	#Success-ful	%Success-ful	Subject's Estimate of Impact of Procedures
5502	2	2	134	28	5	2	1	1	0	0%	Accelerated
5503	2	6	288	120	23	13	4	3	3	100%	Accelerated
5504	1	1	29	20	3	2	0	-	-	-	Accelerated
5508	1	1	122	72	5	1	3	3	2	66%	Accelerated
5512	2	2	72	41	2	0	0	-	-	-	Accelerated
TOTAL	8	12	645	281	38	18	8	7	5	71%	

Table 4-8

UTILIZATION OF SUGGESTED STRATEGIES

Subject	# Interventions	# Usable	# Successful	% Successful	# Using Suggested Strategy	% Using Suggested Strategy	Predictability of Rules
5502	1	1	0	0%	0	0	100%
5503	4	3	3	100%	2	66%	66%
5504	0	-	-	-	-	-	-
5508	3	3	2	66%	2	66%	66%
5512	0	-	-	-	-	-	-
TOTAL	8	7	5	71%	4	57%	71%

Table 4-9

COST SUMMARY

No. Subjects Trained: 12	
Total Training Cost:	$697.36
Total Follow-up Cost:	$121.86
TOTAL SITE COST:	$819.22
Average Per Subject Cost:	$ 68.26
Average Per Pupil Cost:	$ 37.26
Average Per Week Cost**:	$ 8.45

* Includes N=22 pupils whose teachers applied the procedures

** Includes N=97 weeks during which teaches applied procedures

Table 4-10

COSTS FOR SUBJECTS APPLYING PROCEDURES

Application of Procedures				All Costs					Cost Analysis	
Subject	Weeks	Pupils	Programs	Training	Follow-up	Total	Per Pupil	Per Program	Per Week	Per Program/Week
5501	12	1	1	$ 62.40	$ 6.14	$ 68.54	$ 68.54	$ 68.54	$ 5.71	$ 5.72
5502	19	6	6	$ 73.49	$ 52.17	$ 125.66	$ 20.94	$ 20.94	$ 6.61	$ 1.10
5503	16	2	5	$ 81.07	$ 14.34	$ 95.41	$ 47.71	$ 19.08	$ 5.96	$ 1.19
5504	12	1	1	$ 75.02	$ 0.00	$ 75.02	$ 75.02	$ 75.02	$ 6.25	$ 6.27
5507	6	2	4	$ 49.81	$ 0.00	$ 49.81	$ 24.91	$ 12.45	$ 8.18	$ 2.08
5508	6	1	1	$ 56.98	$ 9.35	$ 66.33	$ 66.33	$ 66.33	$ 11.05	$11.06
5510	6	1	1	$ 41.47	$ 25.18	$ 66.65	$ 66.65	$ 66.65	$ 11.11	$11.11
5511	5	1	1	$ 45.42	$ 3.63	$ 49.11	$ 49.11	$ 49.11	$ 9.82	$ 9.82
5512	5	2	2	$ 41.47	$ 5.43	$ 46.90	$ 23.45	$ 23.45	$ 9.98	$ 4.69
5513	4	2	4	$ 63.16	$ 0.00	$ 63.16	$ 31.58	$ 15.79	$ 15.79	$ 3.95
5514	6	3	5	$ 63.16	$ 0.00	$ 63.16	$ 21.05	$ 12.63	$ 10.53	$ 2.11
TOTAL	97	22	31	$653.45	$116.24	$769.69				
MEDIANS						$68.54	$23.45	$19.08	$6.61	$4.69